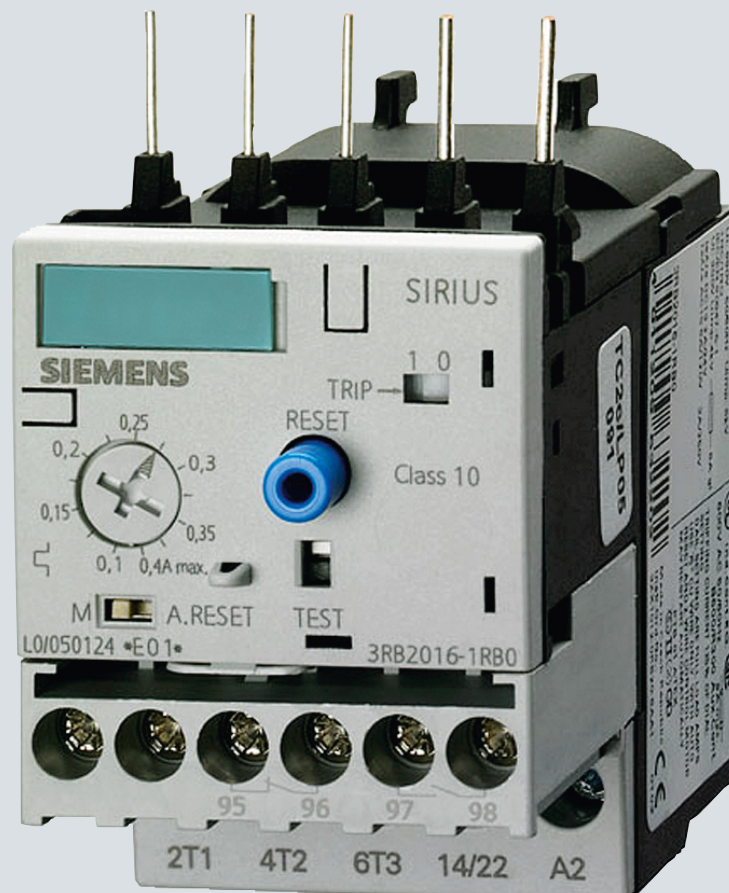


Protection Equipment

AhW/SV DWSke

DWV/W UW? S` gS^ April 2009



Low-Voltage Controls and Distribution

SIEMENS

Protection Equipment



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Overload Relays

General data

Overview



Features	Benefits	3RU11	3RB20/3RB21	3RB22/3RB23
General data				
Sizes	<ul style="list-style-type: none"> Are coordinated with the dimensions, connections and technical characteristics of the other devices in the SIRIUS modular system (contactors, soft starters, ...) Permit the mounting of slim and compact load feeders in widths of 45 mm (S00), 45 mm (S0), 55 mm (S2), 70 mm (S3), 120 mm (S6) and 145 mm (S10/S12) Simplify configuration 	S00 ... S3	S00 ... S12	S00 ... S12
Seamless current range	<ul style="list-style-type: none"> Allows easy and consistent configuration with one series of overload relays (for small to large loads) 	0.11 ... 100 A	0.1 ... 630 A	0.3 ... 630 A (... 820 A) ¹⁾
Protection functions				
Tripping in the event of overload	<ul style="list-style-type: none"> Provides optimum inverse-time delayed protection of loads against excessive temperature rises due to overload 	✓	✓	✓
Tripping in the event of phase unbalance	<ul style="list-style-type: none"> Provides optimum inverse-time delayed protection of loads against excessive temperature rises due to phase unbalance 	(✓)	✓	✓
Tripping in the event of phase failure	<ul style="list-style-type: none"> Minimizes heating of induction motors during phase failure 	✓	✓	✓
Protection of single-phase loads	<ul style="list-style-type: none"> Enables the protection of single-phase loads 	✓	--	✓
Tripping in the event of overheating by integrated thermistor motor protection function	<ul style="list-style-type: none"> Provides optimum temperature-dependent protection of loads against excessive temperature rises, e. g. for stator-critical motors or in the event of insufficient coolant flow, contamination of the motor surface or for long starting or braking operations Eliminates the need for additional special equipment Saves space in the control cabinet Reduces wiring outlay and costs 	-- ²⁾	-- ²⁾	✓
Tripping in the event of a ground fault by internal ground-fault detection (activatable)	<ul style="list-style-type: none"> Provides optimum protection of loads against high-resistance short-circuits or ground faults due to moisture, condensed water, damage to the insulation material, etc. Eliminates the need for additional special equipment Saves space in the control cabinet Reduces wiring outlay and costs 	--	✓ (only 3RB21)	✓
Features				
RESET function	<ul style="list-style-type: none"> Allows manual or automatic resetting of the relay 	✓	✓	✓
Remote RESET function	<ul style="list-style-type: none"> Allows the remote resetting of the relay 	✓ (by means of separate module)	✓ (only 3RB21 with 24 V DC)	✓
TEST function for auxiliary contacts	<ul style="list-style-type: none"> Allows easy checking of the function and wiring 	✓	✓	✓
TEST function for electronics	<ul style="list-style-type: none"> Allows checking of the electronics 	--	✓	✓
Status display	<ul style="list-style-type: none"> Displays the current operating state 	✓	✓	✓
Large current adjustment button	<ul style="list-style-type: none"> Makes it easier to set the relay exactly to the correct current value 	✓	✓	✓
Integrated auxiliary contacts (1 NO + 1 NC)	<ul style="list-style-type: none"> Allows the load to be switched off if necessary Can be used to output signals 	✓	✓	✓ (2 ×)

1) Motor currents up to 820 A can be recorded and evaluated by a current measuring module, e. g. 3RB29 06-2BG1 (0.3 ... 3 A), in combination with a 3UF18 68-3GA00 (820 A/1 A) series transformer.

2) The SIRIUS 3RN thermistor motor protection devices can be used to provide additional temperature-dependent protection.



3RU11

3RB20/3RB21

3RB22/3RB23

Features

Benefits

Design of load feeders

Short-circuit strength up to 100 kA at 690 V

(in conjunction with the corresponding fuses or the corresponding motor starter protector)

- Provides optimum protection of the loads and operating personnel in the event of short-circuits due to insulation faults or faulty switching operations

Electrical and mechanical matching to 3RT1 contactors

- Simplifies configuration
- Reduces wiring outlay and costs
- Enables stand-alone installation as well as space-saving direct mounting

Straight-through transformers for main circuit²⁾

(in this case the cables are routed through the feed-through openings of the overload relay and connected directly to the box terminals of the contactor)

- Reduces the contact resistance (only one point of contact)
- Saves wiring costs (easy, no need for tools, and fast)
- Saves material costs
- Reduces installation costs

Spring-type terminal connection system for main circuit²⁾

- Enables fast connections
- Permits vibration-resistant connections
- Enables maintenance-free connections

Spring-type terminal connection system for auxiliary circuits²⁾

- Enables fast connections
- Permits vibration-resistant connections
- Enables maintenance-free connections

Other features

Temperature compensation

- Allows the use of the relays at high temperatures without derating
- Prevents premature tripping
- Allows compact installation of the control cabinet without distance between the devices/load feeders
- Simplifies configuration
- Enables space to be saved in the control cabinet

Very high long-term stability

- Provides safe protection for the loads even after years of use in severe operating conditions

Wide setting ranges

- Reduce the number of variants
- Minimize the engineering outlay and costs
- Minimize storage overhead, storage costs, tied-up capital

Trip class CLASS 5

- Enables solutions for very fast starting motors requiring special protection (e. g. Ex motors)

Trip classes > CLASS 10

- Enables heavy starting solutions

Low power loss

- Reduces power consumption and energy costs (up 98 % less power is used than for thermal overload relays).
- Minimizes temperature rises of the contactor and control cabinet – in some cases this may eliminate the need for controlgear cabinet cooling.
- Direct mounting to contactor saves space, even for high motor currents (i. e. no heat decoupling is required).

1) Exception: up to size S3, only stand-alone installation is possible.

2) Alternatively available for screw terminals.

Overload Relays

General data



Features	Benefits	3RU11	3RB20/3RB21	3RB22/3RB23
Other features				
Internal power supply	<ul style="list-style-type: none"> Eliminates the need for configuration and connecting an additional control circuit 	-- ¹⁾	✓	--
Variable adjustment of the trip classes (The required trip class can be adjusted by means of a rotary switch depending on the current start-up condition.)	<ul style="list-style-type: none"> Reduces the number of variants Minimizes the configuring outlay and costs Minimizes storage overhead, storage costs, and tied-up capital 	--	✓ (only 3RB21)	✓
Overload warning	<ul style="list-style-type: none"> Indicates imminent tripping of the relay directly on the device due to overload, phase unbalance or phase failure Allows the imminent tripping of the relay to be signaled Allows measures to be taken in time in the event of continuous inverse-time delayed overloads Eliminates the need for an additional device Saves space in the control cabinet Reduces wiring outlay and costs 	--	--	✓
Analog output	<ul style="list-style-type: none"> Allows the output of an analog output signal for actuating moving-coil instruments, feeding programmable logic controllers or transfer to bus systems Eliminates the need for an additional measuring transducer and signal converter Saves space in the control cabinet Reduces wiring outlay and costs 	--	--	✓

1) The SIRIUS 3RU11 thermal overload relays use a bimetal contactor and therefore do not require a control supply voltage.

Overload relay	Current measurement	Current range	Contactors (type, size, rating in kW)							
			3RT10 1	3RT10 2	3RT10 3	3RT10 4	3RT10 5	3RT10 6	3RT10 7	3TF68/69
Type	Type	A	S00	S0	S2	S3	S6	S10	S12	Size 14
			3/4/5.5	5.5/7.5/11	15/18.5/22	30/37/45	55/75/90	110/132/160	200/250	375/450

3RU11 thermal overload relays



3RU11 1	Integrated	0.11 ... 12	✓	--	--	--	--	--	--	--
3RU11 2	Integrated	1.8 ... 25	--	✓	--	--	--	--	--	--
3RU11 3	Integrated	5.5 ... 50	--	--	✓	--	--	--	--	--
3RU11 4	Integrated	18 ... 100	--	--	--	✓	--	--	--	--

3RB20¹⁾ solid-state overload relays



3RB20 1	Integrated	0.1 ... 12	✓	--	--	--	--	--	--	--
3RB20 2	Integrated	0.1 ... 25	--	✓	--	--	--	--	--	--
3RB20 3	Integrated	6 ... 50	--	--	✓	--	--	--	--	--
3RB20 4	Integrated	12.5 ... 100	--	--	--	✓	--	--	--	--
3RB20 5	Integrated	50 ... 200	--	--	--	--	✓	--	--	--
3RB20 6	Integrated	55 ... 630	--	--	--	--	--	✓	✓	✓
3RB20 1 + 3UF18	Integrated	630 ... 820	--	--	--	--	--	--	--	✓

3RB21¹⁾ solid-state overload relays



3RB21 1	Integrated	0.1 ... 12	✓	--	--	--	--	--	--	--
3RB21 2	Integrated	0.1 ... 25	--	✓	--	--	--	--	--	--
3RB21 3	Integrated	6 ... 50	--	--	✓	--	--	--	--	--
3RB21 4	Integrated	12.5 ... 100	--	--	--	✓	--	--	--	--
3RB21 5	Integrated	50 ... 200	--	--	--	--	✓	--	--	--
3RB21 6	Integrated	55 ... 630	--	--	--	--	--	✓	✓	✓
3RB21 1 + 3UF18	Integrated	630 ... 820	--	--	--	--	--	--	--	✓

3RB22/3RB23¹⁾ solid-state overload relays



3RB22/3RB23 +	3RB29 0	0.3 ... 25	✓	✓	--	--	--	--	--	--
	3RB29 0	10 ... 100	--	--	✓	✓	--	--	--	--
	3RB29 5	20 ... 200	--	--	--	--	✓	--	--	--
	3RB29 6	63 ... 630	--	--	--	--	--	✓	✓	✓
	3RB29 0 + 3UF18	630 ... 820	--	--	--	--	--	--	--	✓

1) When using the overload relays with trip class \geq CLASS 20, see "Technical specifications", "Short-Circuit Protection with Fuses for Motor Feeders", and the project planning aid "Configuring SIRIUS Fuseless Load Feeders".

Connection methods

The 3RB20 and 3RB21 relays are available with screw terminals (box terminals) or spring-type terminals on the auxiliary current side; the same applies for the evaluation modules of the 3RB22/3RB23 relays.

The 3RU11 relays come with screw terminals.



Screw terminals (box terminals)



Spring-type terminals

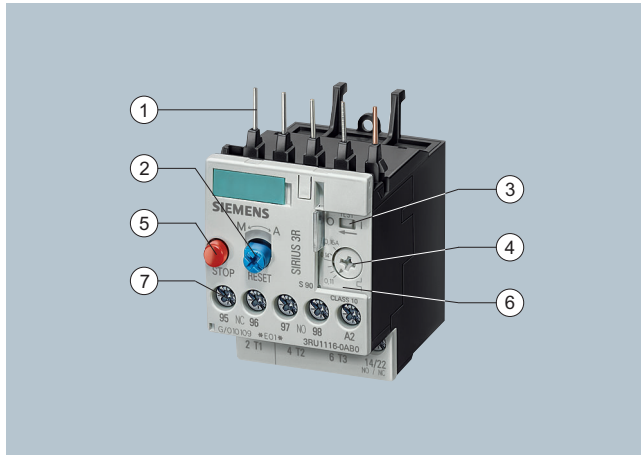
These connections are indicated in the Technical specifications by orange backgrounds.

Overload Relays

3RU1 Thermal Overload Relays

3RU11 for standard applications

Overview



- (1) Connection for mounting onto contactors:
Optimally adapted in electrical, mechanical and design terms to the contactors and soft starters, these connecting pins can be used for direct mounting of the overload relays. Stand-alone installation is possible as an alternative (in some cases in conjunction with a stand-alone installation module).
- (2) Selector switch for manual/automatic RESET and RESET button:
With this switch you can choose between manual and automatic RESET. A device set to manual RESET can be reset locally by pressing the RESET button. A remote RESET is possible using the RESET modules (accessories), which are independent of size.
- (3) Switch position indicator and TEST function of the wiring:
Indicates a trip and enables the wiring test.
- (4) Motor current setting:
Setting the device to the rated motor current is easy with the large rotary knob.
- (5) STOP button:
If the STOP button is pressed, the NC contact is opened. This switches off the contactor downstream. The NC contact is closed again when the button is released.
- (6) Transparent sealable cover
Secures the motor current setting and the TEST function against adjustment.
- (7) Supply terminals:
The generously sized terminals permit connection of two conductors with different cross-sections for the main and auxiliary circuits. The auxiliary circuit can be connected with screw terminals and alternatively with spring-type terminals.

The 3RU11 thermal overload relays up to 100 A have been designed for inverse-time delayed protection of loads with normal starting (see "Function") against excessive temperature rises due to overload or phase failure. An overload or phase failure results in an increase of the motor current beyond the set rated motor current. Via heating elements, this current rise heats up the bimetal strips inside the device which then bend and as a result trigger the auxiliary contacts by means of a tripping mechanism. The auxiliary contacts then switch off the load by means of a contactor. The break time depends on the ratio between the tripping current and current setting I_a and is stored in the form of a long-term stable tripping characteristic (see "Characteristic Curves").

The "tripped" status is signaled by means of a switch position indicator. Resetting takes place either manually or automatically after the recovery time has elapsed (see "Function").

The devices are manufactured in accordance with environmental guidelines and contain environmentally friendly and reusable materials.

They comply with all important worldwide standards and approvals.

"Increased safety" type of protection EEx e acc. to ATEX directive 94/9/EC

The 3RU11 thermal overload relays are suitable for the overload protection of explosion-proof motors with "increased safety" type of protection EEx e;
see Catalog LV 1, Chapter 20 "Appendix" --> "Standards and approvals" --> "Type overview of approved devices for explosion-protected areas (ATEX Explosion Protection)".

EC type test certificate for Category (2) G/D exists. It has the number DMT 98 ATEX G 001.

Design

Device concept

The 3RU11 thermal overload relays are compact devices, i. e. current measurement and the evaluation unit are integrated in a single enclosure.

Mounting options

The 3RU11 thermal overload relays can be mounted directly onto the 3RT1 contactors (exception: size S00 with Cage Clamp terminals can only be installed as a stand-alone installation). With the matching terminal brackets the devices can still be installed as stand-alone units.

For more information on the mounting options see "Technical specifications" and Catalog LV 1, "Selection and ordering data".

Connection methods

All sizes of the 3RU11 thermal overload relays with screw terminal can be connected to the auxiliary and main current paths. Rails can be connected to the main conductor connections of size S3 overload relays if the box terminals are removed.

As an alternative, the devices are also available with Cage Clamp terminals. The auxiliary conductor connections of these devices, and for size S00 the main conductor connections as well, are fitted with Cage Clamp terminals.

For more information on the connection options see "Technical specifications" and Catalog LV 1, "Selection and ordering data".

Overload relays in contactor assemblies for wye-delta starting

When overload relays are used in combination with contactor assemblies for wye-delta starting it must be noted that only 0.58 times the motor current flows through the line contactor. An overload relay mounted onto the line contactor must be set to 0.58 times the motor current.

An assignment of the 3RU11 thermal overload relays to the line contactors of our 3RA contactor assemblies for wye-delta starting can be found in Chapter 3 "Controls: Contactors and Contactor Assemblies".

Operation with frequency converter

The 3RU11 thermal overload relays are suitable for operation with frequency converters. Depending on the frequency of the converter, a higher current than the motor current must be used in some cases due to eddy-currents and skin effects.

Function

Basic functions

The 3RU11 thermal overload relays are designed for:

- Inverse-time delayed protection of loads from overloading
- Inverse-time delayed protection of loads from phase failure

Control circuit

The 3RU11 thermal overload relays do not require an additional supply voltage for operation.

Short-circuit protection

Fuses or motor starter protectors must be used for short-circuit protection.

For assignments of the corresponding short-circuit protection devices to the 3RU11 thermal overload relays with/without contactor see "Technical specifications" and Catalog LV 1, "Selection and ordering data".

Trip classes

The 3RU11 thermal overload relays are available for normal starting conditions with trip class CLASS 10. For heavy starting conditions see 3RB2 solid-state overload relays.

For details of the trip classes see "Characteristic Curves".

Phase failure protection

The 3RU11 thermal overload relays are fitted with phase failure sensitivity (see "Characteristic Curves") in order to minimize temperature rises of the load in the case of a phase failure during single-phase operation.

Setting

The 3RU11 thermal overload relays are set to the rated motor current by means of a rotary knob. The scale of the rotary knob is shown in ampere.

Manual and automatic reset

Automatic and manual reset is selected by pressing and turning the blue button (RESET button). If the button is set to manual reset, the overload relay can be reset directly by pressing the RESET button. Resetting is possible in combination with mechanical and electrical reset options from the range of accessories (see Catalog LV 1, "Accessories"). If the blue button is set to automatic RESET, the relay is reset automatically.

The time between tripping and resetting is determined by the recovery time.

Recovery time

After tripping due to overload, the 3RU11 thermal overload relays require some time until the bimetal strips have cooled down. The device can only be reset after the bimetal strips have cooled down. This time (recovery time) depends on the tripping characteristics and strength of the tripping current.

The recovery time allows the load to cool down after tripping due to overload.

TEST function

The TEST slide can be used to check whether the operational 3RU11 thermal overload relay is working properly. Actuating the slide simulates tripping of the relay. During this simulation the NC contact (95-96) is opened and the NO contact (97-98) is closed. This tests whether the auxiliary circuit has been correctly connected to the overload relay. If the 3RU11 thermal overload relay has been set to automatic RESET, the overload relay is automatically reset when the TEST slide is released. The relay must be reset with the RESET button if it has been set to manual RESET.

STOP function

If the STOP button is pressed, the NC contact is opened. This switches off the contactor downstream and thus the load. The load is switched on again when the STOP button is released.

Display of the operating state

The respective operating state of the 3RU11 thermal overload relay is displayed by means of the position of the marking on the TEST function/switch position indicator slide. After tripping due to overload or phase failure, the marking on the slide is to left on the "O" mark, otherwise it is on the "I" mark.

Auxiliary contacts


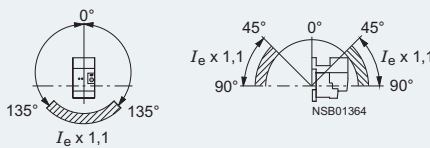
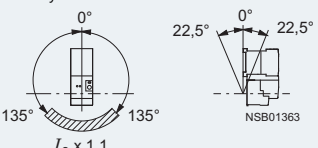
The 3RU11 thermal overload relays are fitted with an NO contact for the tripped signal, and an NC contact for disconnecting the contactor.

Overload Relays

3RU1 Thermal Overload Relays

3RU11 for standard applications

Technical specifications



Type	3RU11 16	3RU11 26	3RU11 36	3RU11 46
Size	S00	S0	S2	S3
Width	45 mm	45 mm	55 mm	70 mm
General data				
Trips in the event of		Overload and phase failure		
Trip class acc. to IEC 60947-4-1		CLASS	10	
Phase failure sensitivity		Yes		
Overload warning		No		
Reset and recovery		Manual, automatic and remote RESET ¹⁾		
• Reset options after tripping				
• Recovery time				
- For automatic RESET		min	Depends on the strength of the tripping current and characteristic	
- For manual RESET		min	Depends on the strength of the tripping current and characteristic	
- For remote RESET		min	Depends on the strength of the tripping current and characteristic	
Features		Yes, by means of TEST function/switch position indicator slide		
• Display of operating state on device		Yes		
• TEST function		Yes		
• RESET button		Yes		
• STOP button		Yes		
Safe operation of motors with "increased safety" type of protection		DMT 98 ATEX G 001  II (2) GD, DMT 98 ATEX G 001 N1		
EC type test certificate number acc. to directive 94/9/EC				
Ambient temperature				
• Storage/transport		°C	-55 ... +80	
• Operation		°C	-20 ... +70	
• Temperature compensation		°C	Up to 60	
• Permissible rated current at				
- Temperature inside control cabinet 60 °C		%	100 (over +60 °C current reduction is not required)	
- Temperature inside control cabinet 70 °C		%	87	
Repeat terminals				
• Coil repeat terminal		Yes	Not required	
• Auxiliary contact repeat terminal		Yes	Not required	
Degree of protection acc. to IEC 60529		IP20		IP20 ²⁾
Touch protection acc. to IEC 61140		Finger-safe		
Shock resistance with sine acc. to IEC 60068-2-27		g/ms	8/10	
Electromagnetic compatibility (EMC) – Interference immunity				
• Conductor-related interference				
- Burst acc. to IEC 61000-4-4 (corresponds to degree of severity 3)		kV	EMC interference immunity is not relevant for thermal overload relays	
- Surge acc. to IEC 61000-4-5 (corresponds to degree of severity 3)		kV	EMC interference immunity is not relevant for thermal overload relays	
• Electrostatic discharge acc. to IEC 61000-4-2 (corresponds to degree of severity 3)		kV	EMC interference immunity is not relevant for thermal overload relays	
• Field-related interference acc. to IEC 61000-4-3 (corresponds to degree of severity 3)		V/m	EMC interference immunity is not relevant for thermal overload relays	
Electromagnetic compatibility (EMC) – Emitted interference		EMC interference immunity is not relevant for thermal overload relays		
Resistance to extreme climates – Air humidity		%	100	
Dimensions		See dimensional drawings		
Installation altitude above sea level		m	Up to 2000; above this, please enquire	
Mounting position		The diagrams show the permissible mounting positions for mounting onto contactors and stand-alone installation. For installation in the hatched area, a setting correction of 10 % must be implemented. Stand-alone installation:  Contactor + overload relay: 		
Type of mounting		Direct mounting ^{3)/} stand-alone installation with terminal bracket ⁴⁾ Direct mounting/stand-alone installation with terminal bracket ⁴⁾		

Footnotes see page 11.

Overload Relays

3RU1 Thermal Overload Relays

3RU11 for standard applications

Type		3RU11 16	3RU11 26	3RU11 36	3RU11 46
Size		S00	S0	S2	S3
Width		45 mm	45 mm	55 mm	70 mm
Main circuit					
Rated insulation voltage U_i (degree of pollution 3)	V	690			1000
Rated impulse withstand voltage U_{imp}	kV	6			8
Rated operational voltage U_e	V	690			1000
Type of current		Yes			
• Direct current		Yes, frequency range up to 400 Hz			
• Alternating current					
Current setting	A	0.11 ... 0.16 to 9 ... 12	1.8 ... 2.5 to 20 ... 25	5.5 ... 8 to 40 ... 50	18 ... 25 to 80 ... 100
Power loss per unit (max.)	W	3.9 ... 6.6	3.9 ... 6	6 ... 9	10 ... 16.5
Short-circuit protection		See "Selection and ordering data"			
• With fuse without contactor		See "Technical specifications" (short-circuit protection with fuses/motor starter protectors for motor feeders)			
• With fuse and contactor					
Protective separation between main and auxiliary conducting path acc. to IEC 60947-1	V	500	690		
Connection for main circuit					
Connection type		 Screw terminals with box terminal			
• Terminal screw		Pozidriv size 2			
• Tightening torque	Nm	0.8 ... 1.2	2 ... 2.5	3 ... 4.5	4 ... 6
• Conductor cross-sections (min./max.), 1 or 2 conductors					
- Solid	mm ²	2 x (0.5 ... 1.5) ²⁾ 2 x (0.75 ... 2.5) ²⁾ Max. 2 x (1 ... 4) ²⁾	2 x (1 ... 2.5) ²⁾ 2 x (2.5 ... 6) ²⁾ Max. 2 x (2.5 ... 10) ²⁾	2 x (0.75 ... 16)	2 x (2.5 ... 16)
- Finely stranded with end sleeve	mm ²	2 x (0.5 ... 1.5) ²⁾ 2 x (0.75 ... 2.5) ²⁾	2 x (1 ... 2.5) ²⁾ 2 x (2.5 ... 6) ²⁾	2 x (0.75 ... 16) 1 x (0.75 ... 25)	2 x (2.5 ... 35) 1 x (2.5 ... 50)
- Stranded	mm ²	2 x (0.5 ... 1.5) ²⁾ 2 x (0.75 ... 2.5) ²⁾ Max. 2 x (1 ... 4) ²⁾	2 x (1 ... 2.5) ²⁾ 2 x (2.5 ... 6) ²⁾ Max. 2 x (2.5 ... 10) ²⁾	2 x (0.75 ... 25) 1 x (0.75 ... 35)	2 x (10 ... 50) 1 x (10 ... 70)
- AWG cables, solid or stranded	AWG	2 x (18 ... 14)	2 x (14 ... 10)	2 x (18 ... 3) 1 x (18 ... 1)	2 x (10 ... 1/0) 1 x (10 ... 2/0)
- Ribbon cable conductors (number x width x thickness)	mm	--	--	2 x (6 x 9 x 0.8)	2 x (6 x 9 x 0.8)
Busbar connections					
• Terminal screw		Busbar connection¹⁾			
• Tightening torque	Nm	--	--	--	M6 x 20 4 ... 6
• Conductor cross-sections (min./max.)					
- Finely stranded with cable lug	mm ²	--	--	--	2 x 70
- Stranded with cable lug	mm ²	--	--	--	3 x 70
- AWG cables, solid or stranded, with cable lug	AWG	--	--	--	2/0
- With connecting bar (max. width)	mm	--	--	--	12
Connection type		 Cage Clamp terminals			
• Conductor cross-sections (min./max.)					
- Solid	mm ²	2 x (0.25 ... 2.5)	--	--	--
- Finely stranded without end sleeve	mm ²	2 x (0.25 ... 2.5)	--	--	--
- Finely stranded with end sleeve	mm ²	2 x (0.25 ... 1.5)	--	--	--
- Stranded	mm ²	--	--	--	--
- AWG cables, solid or stranded	AWG	2 x (24 ... 14)	--	--	--

Footnotes for page 10:

- 1) Remote RESET in combination with the corresponding accessories.
- 2) Terminal compartment: degree of protection IP00.
- 3) The 3RU11 16 overload relay with Cage Clamp terminals can only be installed as a stand-alone installation.
- 4) For screw and snap-on mounting TH 35 standard mounting rail; size S3 also for TH 75 standard mounting rail. For more detailed information about terminal brackets see "Accessories" --> "Technical specifications".



Footnotes for page 11:

- 1) The box terminal is removable. Rail and cable lug connections are possible if the box terminal is removed.
- 2) If two different conductor cross-sections are connected to one clamping point, both cross-sections must lie in the range specified. If identical cross-sections are used, this restriction does not apply.

Overload Relays

3RU1 Thermal Overload Relays

3RU11 for standard applications

Type		3RU11 16	3RU11 26	3RU11 36	3RU11 46
Size		S00	S0	S2	S3
Width		45 mm	45 mm	55 mm	70 mm
Auxiliary circuit					
Number of NO contacts		1			
Number of NC contacts		1			
Auxiliary contacts – assignment		1 NO for the signal "tripped", 1 NC for disconnecting the contactor			
Rated insulation voltage U_i (degree of pollution 3)	V	690			
Rated impulse withstand voltage U_{imp}	kV	6			
Contact rating of the auxiliary contacts					
• NC contact with alternating current AC-14/AC-15, rated operational current I_e at U_e :					
- 24 V	A	4			
- 120 V	A	4			
- 125 V	A	4			
- 230 V	A	3			
- 400 V	A	2			
- 600 V	A	0.6			
- 690 V	A	0.5			
• NO contact with alternating current AC-14/AC-15, rated operational current I_e at U_e :					
- 24 V	A	3			
- 120 V	A	3			
- 125 V	A	3			
- 230 V	A	2			
- 400 V	A	1			
- 600 V	A	0.6			
- 690 V	A	0.5			
• NC contact, NO contact with direct current DC-13, rated operational current I_e at U_e :					
- 24 V	A	1			
- 60 V	A	1)			
- 110 V	A	0.22			
- 125 V	A	0.22			
- 220 V	A	0.11			
• Conventional thermal current I_{th}	A	6 ²⁾			
• Contact reliability (suitability for PLC control; 17 V, 5 mA)		Yes			
Short-circuit protection					
• With fuse					
- gL/gG operational class	A	6			
- Quick	A	10			
• With miniature circuit breaker (C characteristic)	A	6			
Protective separation between main and auxiliary conducting path	V	415			
Acc. to IEC 60947-1					
CSA, UL, UR rated data					
Auxiliary circuit – switching capacity		B600, R300			
Connection of the auxiliary circuit					
Connection type		 Screw terminals			
• Terminal screw		Pozidriv size 2			
• Tightening torque	Nm	0.8 ... 1.2			
• Conductor cross-sections (min./max.), 1 or 2 conductors					
- Solid	mm ²	2 x (0.5 ... 1.5) ³⁾ , 2 x (0.75 ... 2.5) ³⁾			
- Finely stranded without end sleeve	mm ²	--			
- Finely stranded with end sleeve	mm ²	2 x (0.5 ... 1.5) ³⁾ , 2 x (0.75 ... 2.5) ³⁾			
- Stranded	mm ²	2 x (0.5 ... 1.5) ³⁾ , 2 x (0.75 ... 2.5) ³⁾			
- AWG cables, solid or stranded	AWG	2 x (18 ... 14)			
Connection type		 Cage Clamp terminals			
• Conductor cross-sections (min./max.)					
- Solid		2 x (0.25 ... 2.5)			
- Finely stranded without end sleeve		2 x (0.25 ... 2.5)			
- Finely stranded with end sleeve		2 x (0.25 ... 1.5)			
- Stranded		--			
- AWG cables, solid or stranded		2 x (24 ... 14)			

1) On request.

2) Up to $I_k \leq 0.5$ kA; ≤ 260 V.

3) If two different conductor cross-sections are connected to one clamping point, both cross-sections must lie in the range specified. If identical cross-sections are used, this restriction does not apply.

Overload Relays

3RU1 Thermal Overload Relays

3RU11 for standard applications

Short-circuit protection with fuses/motor starter protectors for motor feeders

With short-circuit currents up to 100 kA at rated operational voltages up to AC 50/60 Hz 690 V

Permissible short-circuit protection fuse for motor starters comprising overload relay and contactor, type of coordination 2¹⁾

Overload relay Setting range	3 kW \cong 3RT10 15 $I_{e\max} = 7\text{ A}$ (at AC 50 Hz 400 V)			4 kW \cong 3RT10 16 $I_{e\max} = 9\text{ A}$ (at AC 50 Hz 400 V)			5.5 kW \cong 3RT10 17 $I_{e\max} = 12\text{ A}$ (at AC 50 Hz 400 V)			UL-listed fuses RK5	Motor starter protector for starter combinations at $I_q = 50\text{ kA/400 V AC}$
A	gL/gG	aM	BS 88	gL/gG	aM	BS 88	gL/gG	aM	BS 88	A	
Size S00											
0.11 ... 0.16	0.5	--	--	0.5	--	--	0.5	--	--	1	--
0.14 ... 0.2	1	--	--	1	--	--	1	--	--	1	3RV13 21-0BC10
0.18 ... 0.25	1	--	--	1	--	--	1	--	--	1	3RV13 21-0CC10
0.22 ... 0.32	1.6	--	2	1.6	--	2	1.6	--	2	1	3RV13 21-0DC10
0.28 ... 0.4	2	--	2	2	--	2	2	--	2	1.6	3RV13 21-0EC10
0.35 ... 0.5	2	--	2	2	--	2	2	--	2	2	3RV13 21-0FC10
0.45 ... 0.63	2	--	4	2	--	4	2	--	4	2.5	3RV13 21-0GC10
0.55 ... 0.8	4	--	4	4	--	4	4	--	4	3	3RV13 21-0HC10
0.7 ... 1	4	--	6	4	--	6	4	--	6	4	3RV13 21-0JC10
0.9 ... 1.25	4	--	6	4	--	6	4	--	6	5	3RV13 21-0KC10
1.1 ... 1.6	6	--	10	6	--	10	6	--	10	6	3RV13 21-1AC10
1.4 ... 2	6	--	10	6	--	10	6	--	10	8	3RV13 21-1BC10
1.8 ... 2.5	10	--	10	10	--	10	10	--	10	10	--
2.2 ... 3.2	10	--	16	10	--	16	10	--	16	12	--
2.8 ... 4	16	--	16	16	--	16	16	--	16	16	--
3.5 ... 5	20	6	20	20	6	20	20	6	20	20	--
4.5 ... 6.3	20	6	20	20	6	20	20	6	20	25	--
5.5 ... 8	20	10	20	20	10	20	20	10	20	30	--
7 ... 10	--	--	--	20	16	20	20	16	20	40	--
9 ... 12	--	--	--	--	--	--	20	16	25	45	--

Overload relay Setting range	5.5 kW \cong 3RT10 24 $I_{e\max} = 12\text{ A}$ (at AC 50 Hz 400 V)			7.5 kW \cong 3RT10 25 $I_{e\max} = 17\text{ A}$ (at AC 50 Hz 400 V)			11 kW \cong 3RT10 26 $I_{e\max} = 25\text{ A}$ (at AC 50 Hz 400 V)			UL-listed fuses RK5	Motor starter protector for starter combinations at $I_q = 50\text{ kA/400 V AC}$
A	gL/gG	aM	BS 88	gL/gG	aM	BS 88	gL/gG	aM	BS 88	A	
Size S0											
1.8 ... 2.5	10	--	10	10	--	10	10	--	10	10	3RV13 21-1CC10
2.2 ... 3.2	10	--	16	10	--	16	10	--	16	12	3RV13 21-1DC10
2.8 ... 4	16	--	16	16	--	16	16	--	16	16	3RV13 21-1EC10
3.5 ... 5	20	6	20	20	6	20	20	6	20	20	3RV13 21-1FC10
4.5 ... 6.3	20	6	25	20	6	25	20	6	25	25	3RV13 21-1GC10
5.5 ... 8	25	10	25/32 ²⁾	25	10	25/32 ²⁾	25	10	32	30	3RV13 21-1HC10
7 ... 10	25	16	25/32 ²⁾	25	16	25/32 ²⁾	32	16	35	40	3RV13 21-1JC10
9 ... 12.5	25	20	25/32 ²⁾	25	20	25/32 ²⁾	35	20	35	45	3RV13 21-1KC10
11 ... 16	25	20	25/32 ²⁾	25	20	25/32 ²⁾	35	20	35	60	3RV13 21-4AC10
14 ... 20	--	--	--	25	20	25/32 ²⁾	35	20	35	80	3RV13 21-4BC10
17 ... 22	--	--	--	--	--	--	35	20	35	80	3RV13 21-4CC10
20 ... 25	--	--	--	--	--	--	35	20	35	100	--

For type of coordination "1"¹⁾ see short-circuit protection of the contactors without overload relay under "Controls - Contactors and Contactor Assemblies".

1) Assignment and short-circuit protective devices according to IEC 60947-4-1:

The contactor or starter must not endanger persons or the installation in the event of a short-circuit.

Type of coordination "1": The contactor or the starter may be non-operational after every short-circuit release.

Type of coordination "2": The contactor or the starter must be operational after a short-circuit release (without replacement of parts). Welding of the contacts is permissible however.

2) At max. 415 V.

Overload Relays

3RU1 Thermal Overload Relays

3RU11 for standard applications

Short-circuit protection with fuses/motor starter protectors for motor feeders

With short-circuit currents up to 100 kA at rated operational voltages up to AC 50/60 Hz 690 V

Permissible short-circuit protection fuse for motor starters comprising overload relay and contactor, type of coordination 2¹⁾

Overload relay Setting range	15 kW \cong 3RT10 34 $I_{e\ max} = 32\ A$ (at AC 50 Hz 400 V)			18.5 kW \cong 3RT10 35 $I_{e\ max} = 40\ A$ (at AC 50 Hz 400 V)			22 kW \cong 3RT10 36 $I_{e\ max} = 50\ A$ (at AC 50 Hz 400 V)			UL-listed fuses RK5	Motor starter protector for starter combinations at $I_q = 50\ kA/400\ V\ AC$
A	gL/gG	aM	BS 88	gL/gG	aM	BS 88	gL/gG	aM	BS 88	A	
Size S2											
5.5 ... 8	25	10	25	25	10	25	25	10	25	30	--
7 ... 10	32	16	32	32	16	32	32	16	32	40	--
9 ... 12.5	35	16	35	35	16	35	35	16	35	50	--
11 ... 16	40	20	40	40	20	40	40	20	40	60	--
14 ... 20	50	25	50	50	25	50	50	25	50	80	--
18 ... 25	63	32	63	63	32	63	63	32	63	100	3RV13 31-4DC10
22 ... 32	63	35	63	63	35	63	80	35	80	125	3RV13 31-4EC10
28 ... 40	63	50	63	63	50	63	80	50	80	150	3RV13 31-4FC10
36 ... 45	--	--	--	63	50	80	80	50	80	175	3RV13 31-4GC10
40 ... 50	--	--	--	--	--	--	80	50	80	200	3RV13 31-4HC10

Overload relay Setting range	30 kW \cong 3RT10 44 $I_{e\ max} = 65\ A$ (at AC 50 Hz 400 V)			37 kW \cong 3RT10 45 $I_{e\ max} = 80\ A$ (at AC 50 Hz 400 V)			45 kW \cong 3RT10 46 $I_{e\ max} = 95\ A$ (at AC 50 Hz 400 V)			UL-listed fuses RK5	Motor starter protector for starter combinations at $I_q = 50\ kA/400\ V\ AC$
A	gL/gG	aM	BS 88	gL/gG	aM	BS 88	gL/gG	aM	BS 88	A	
Size S3											
18 ... 25	63	32	63	63	32	63	63	32	63	100	--
22 ... 32	80	35	80	80	35	80	80	35	80	125	--
28 ... 40	80	50	80	80	50	80	80	50	80	150	--
36 ... 50	125	50	125	125	50	125	125	50	125	200	--
45 ... 63	125	63	125	160	63	160	160	63	160	250	3RV13 41-4JC10
57 ... 75	--	--	--	160	80	160	160	80	160	300	3RV13 41-4KC10
70 ... 90	--	--	--	--	--	--	160	100	160	350	3RV13 41-4LC10
80 ... 100	--	--	--	--	--	--	160	100	160	350	3RV13 41-4MC10

For type of coordination "1"¹⁾ see short-circuit protection of the contactors without overload relay under "Controls - Contactors and Contactor Assemblies".

1) Assignment and short-circuit protective devices according to IEC 60947-4-1:

The contactor or starter must not endanger persons or the installation in the event of a short-circuit.

Type of coordination "1": The contactor or the starter may be non-operational after every short-circuit release.

Type of coordination "2": The contactor or the starter must be operational after a short-circuit release (without replacement of parts). Welding of the contacts is permissible however.

Characteristic curves

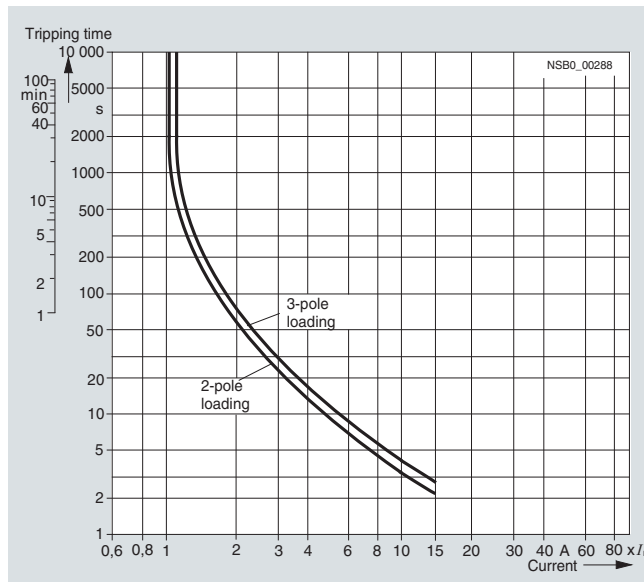
The tripping characteristics show the relationship between the tripping time and tripping current as multiples of the current setting I_e and are given for symmetrical three-pole and two-pole loads from the cold state.

The smallest current used for tripping is called the minimum tripping current. According to IEC 60947-4-1, this current must be within specified limits. The limits of the minimum tripping current for the 3RU11 thermal overload relays for symmetrical three-pole loads are between 105 and 120 % of the current setting.

The tripping characteristic starts with the minimum tripping current and continues with higher tripping currents based on the characteristics of the so-called trip classes (CLASS 10, CLASS 20 etc.). The trip classes describe time intervals within which the overload relays have to trip with 7.2 times the current setting I_e from the cold state for symmetrical three-pole loads.

The tripping times are as follows for:

Trip class	Tripping times
CLASS 10A	2 s ... 10 s
CLASS 10	4 s ... 10 s
CLASS 20	6 s ... 20 s
CLASS 30	9 s ... 30 s



This is the schematic representation of a characteristic curve. The characteristic curves of the individual 3RU11 thermal overload relays can be ordered from "Technical Assistance":

- Either by e-mail to:
technical-assistance@siemens.com
- Or on the Internet at:
<http://www.siemens.com/automation/service&support>

The tripping characteristic for a three-pole 3RU11 thermal overload relay (see characteristic curve for symmetrical three-pole loads from the cold state) only applies if all three bimetal strips are simultaneously loaded with the same current. If only two bimetal strips are heated due to a phase failure, these two strips alone must generate the necessary force to trigger the tripping mechanism which would result in a longer tripping time or require a higher current. If these higher currents are applied over a longer period, they usually cause damage to the load. To avoid damage, the 3RU11 thermal overload relays are fitted with phase failure sensitivity which ensures faster tripping in accordance with the characteristic curve for 2-pole loads from the cold state by means of a suitable mechanical mechanism.

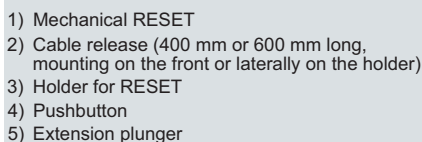
Compared with a cold load, a load at operating temperature obviously has a lower temperature reserve. This is taken into account by the 3RU11 thermal overload relays by reducing the tripping time to about 25 % when loaded with the current setting I_e for an extended period.

3RU11 for standard applications

Screw connection

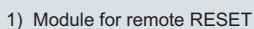
3RU11 16-..B0

Size S00, with mechanical RESET



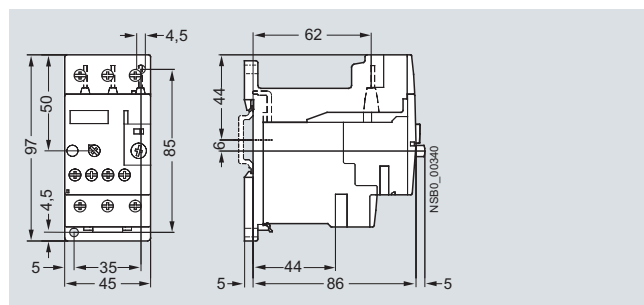
3RU11 16-..B.

Size S00, with terminal bracket for stand-alone installation, with remote RESET



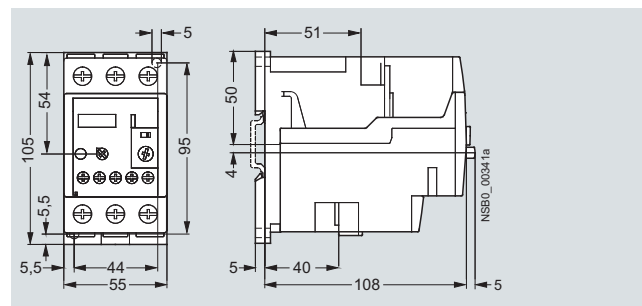
3RU11 26-..B.

Size S0, with terminal bracket for stand-alone installation



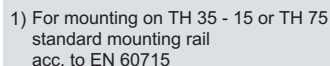
3RU11 36-..B.

Size S2, with terminal bracket for stand-alone installation



3RU11 46-..B.

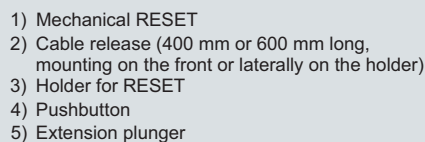
Size S3, with terminal bracket for stand-alone installation



The lateral distance to grounded components must be at least 6 mm.

3RU11 16 -..C1

Size S00, with mechanical RESET
(same for sizes S00 to S3).



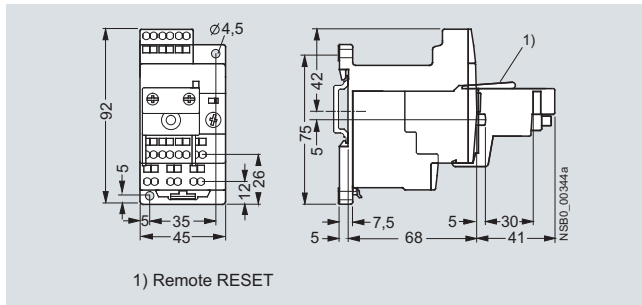
Overload Relays

3RU1 Thermal Overload Relays

3RU11 for standard applications

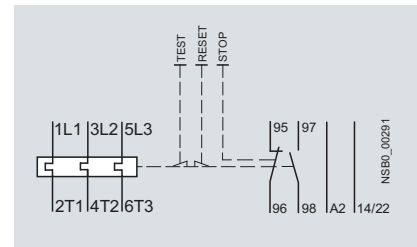
3RU11 16-..C1

Size S00, with remote RESET



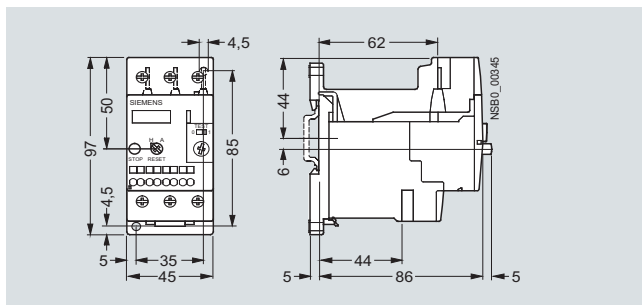
Schematics

3RU11 16

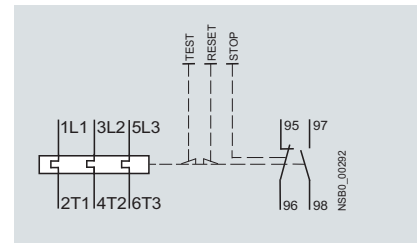


3RU11 26-..D.

Size S0, with terminal bracket for stand-alone installation

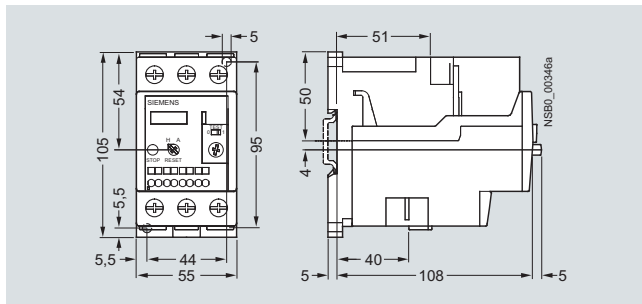


3RU11 26 to 3RU11 46

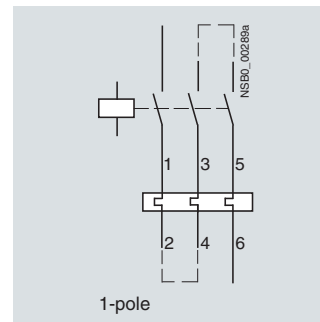


3RU11 36-..D.

Size S2, with terminal bracket for stand-alone installation

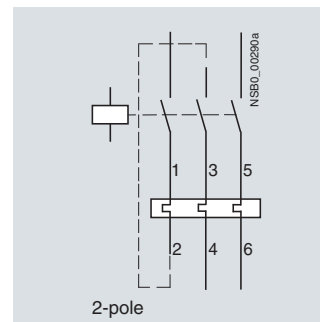
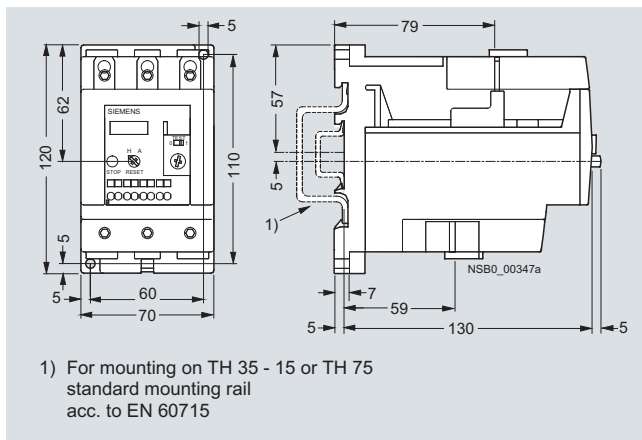


Protection of DC motors



3RU11 46-..D.

Size S3, with terminal bracket for stand-alone installation



For dimensional drawings of overload relays mounted onto contactors see Contactors and Contactor Assemblies.

Overload Relays

3RU1 Thermal Overload Relays

Accessories



Overview

The following accessories are available for the 3RU11 thermal overload relays:

- For the four overload relay sizes S00 to S3 one terminal bracket each for stand-alone installation
- One electrical remote RESET module in three voltage variants for all sizes
- One mechanical RESET module for all sizes
- One cable release for resetting devices which are difficult to access (for all sizes)
- Terminal covers

Technical specifications

Terminal brackets for stand-alone installation

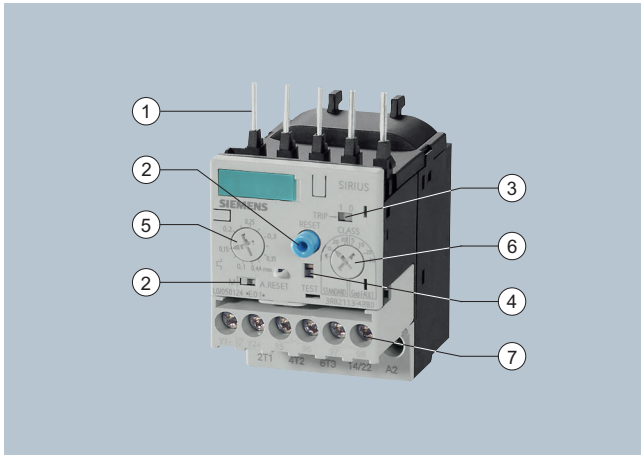
Type	3RU19 16-3AA01		3RU19 26-3AA01		3RU1 936-3AA01		3RU19 46-3AA01	
For overload relays	3RU11 16		3RU11 26		3RU11 36		3RU11 46	
Mounting type	For screw and snap-on mounting onto TH 35 standard mounting rails, size S3 also for TH 75 standard mounting rails.							
Connection for main circuit								
Connection type		 Screw terminals			 Screw terminals with box terminal			
• Terminal screw		Pozidriv size 2			Allen screw 4 mm			
• Conductor cross-section (min./max.), 1 or 2 conductors								
- Solid	mm ²	1 x (0.5 ... 2.5), max. 1 x (... 4)	1 x (1 ... 6), max. 1 x (... 10)	2 x (0.75 ... 16)	2 x (2.5 ... 16)			
- Finely stranded without end sleeve	mm ²	--						
- Finely stranded with end sleeve	mm ²	1 x (0.5 ... 2.5)	1 x (1 ... 6)	2 x (0.75 ... 16), 1 x (0.75 ... 25)	2 x (2.5 ... 35), 1 x (2.5 ... 50)			
- Stranded	mm ²	1 x (0.5 ... 2.5), max. 1 x (... 4)	1 x (1 ... 6), max. 1 x (... 10)	2 x (0.75 ... 25), 1 x (0.75 ... 35)	2 x (10 ... 50), 1 x (10 ... 70)			
- AWG cables, solid or stranded	AWG	1 x (18 ... 14)	1 x (14 ... 10)	2 x (18 ... 3), 1 x (18 ... 1)	2 x (10 ... 1/0), 1 x (10 ... 2/0)			
- Ribbon cable conductors (number x width x thickness)	mm	--	--	2 x (6 x 9 x 0.8)	2 x (6 x 9 x 0.8)			

Overload Relays

3RB2 Solid-State Overload Relays

3RB20, 3RB21 for standard applications

Overview



- (1) Connection for mounting onto contactors:
Optimally adapted in electrical, mechanical and design terms to the contactors and soft starters, these connecting pins can be used for direct mounting of the overload relays. Stand-alone installation is possible as an alternative (in some cases in conjunction with a stand-alone installation module).
- (2) Selector switch for manual/automatic RESET and RESET button:
With the slide switch you can choose between manual and automatic RESET. A device set to manual RESET can be reset locally by pressing the RESET button. On the 3RB21 a solid-state remote RESET is integrated.
- (3) Switch position indicator and TEST function of the wiring:
Indicates a trip and enables the wiring test.
- (4) Solid-state test (device test):
Enables a test of all important device components and functions.
- (5) Motor current setting:
Setting the device to the rated motor current is easy with the large rotary knob.
- (6) Trip class setting/internal ground-fault detection (only 3RB21):
Using the rotary switch you can set the required trip class and activate the internal ground-fault detection dependent on the start-up conditions.
- (7) Connecting terminals (removable joint block for auxiliary circuits):
The generously sized terminals permit connection of two conductors with different cross-sections for the main and auxiliary circuits. The auxiliary circuit can be connected with screw terminals and alternatively with spring-type terminals.

The 3RB20 and 3RB21 solid-state overload relays up to 630 A with internal power supply have been designed for inverse-time delayed protection of loads with normal and heavy starting (see "Function") against excessive temperature rises due to overload, phase unbalance or phase failure. An overload, phase unbalance or phase failure result in an increase of the motor current beyond the set rated motor current. This current rise is detected by the current transformers integrated into the devices and evaluated by corresponding solid-state circuits which then output a pulse to the auxiliary contacts. The auxiliary contacts then switch off the load by means of a contactor. The break time depends on the ratio between the tripping current and current setting I_e and is stored in the form of a long-term stable tripping characteristic (see "Characteristic Curves").

In addition to inverse-time delayed protection of loads against excessive temperature rises due to overload, phase unbalance and phase failure, the 3RB21 solid-state overload relays also allow internal ground-fault detection (not possible in conjunction with contactor assemblies for wye-delta starting). This provides protection of loads against high-resistance short-circuits due to damage to the insulation material, moisture, condensed water etc.

The "tripped" status is signaled by means of a switch position indicator. Resetting takes place either manually or automatically after the recovery time has elapsed (see "Function").

The devices are manufactured in accordance with environmental guidelines and contain environmentally friendly and reusable materials. They comply with all important worldwide standards and approvals.

"Increased safety" type of protection EEx e acc. to ATEX directive 94/9/EC

The 3RB20/3RB21 solid-state overload relays are suitable for the overload protection of explosion-proof motors with "increased safety" type of protection EEx e; see Catalog LV 1, Chapter 20 "Appendix" --> "Standards and approvals" --> "Type overview of approved devices for explosion-protected areas (ATEX Explosion Protection)".

Design

Device concept

The 3RB20/3RB21 solid-state overload relays are compact devices, i. e. current measurement (transformer) and the evaluation unit are integrated in a single enclosure.

Mounting options

The 3RB20/3RB21 solid-state overload relays are suitable for direct and space-saving mounting onto 3RT1 contactors and 3RW30/3RW31 soft starters as well as for stand-alone installation.

For more information on the mounting options see "Technical specifications" and Catalog LV 1, "Selection and ordering data".

Connection methods

Main circuit

All sizes of the 3RB20/3RB21 solid-state overload relays can be connected with screw terminals. As an alternative for sizes S3 to S10/S12, the main current paths can be connected with the help of rails. Sizes S2 to S6 of the 3RB20/3RB21 relays are also available with a straight-through transformer. In this case, the cables of the main circuit are routed directly through the feed-through openings of the relay to the contactor terminals.

Auxiliary circuit

Connection of the auxiliary circuit (removable terminal block) is possible with either screw or spring-type terminal connection system (special device variants).

For more information on the connection options see "Technical specifications" and Catalog LV 1, "Selection and ordering data".

Overload relays in contactor assemblies for wye-delta starting

When overload relays are used in combination with contactor assemblies for wye-delta starting it must be noted that only 0.58 times the motor current flows through the line contactor. An overload relay mounted onto the line contactor must be set to 0.58 times the motor current.

An assignment of the 3RB20 solid-state overload relays to the line contactors of our 3RA contactor assemblies for wye-delta starting can be found in Chapter 3 "Controls: Contactors and Contactor Assemblies".

When 3RB21 solid-state overload relays are used in combination with contactor assemblies for wye-delta starting, the internal ground-fault detection must not be activated.

Operation with frequency converter

The 3RB20/3RB21 solid-state overload relays are suitable for frequencies of 50/60 Hz and the associated harmonics. This permits the 3RB20/3RB21 overload relays to be used on the input side of the frequency converter.

If motor protection is required on the outgoing side of the frequency converter, Siemens recommends the 3RN thermistor motor protection devices or the 3RU11 thermal overload relays for this purpose.

Overload Relays

3RB2 Solid-State Overload Relays

3RB20, 3RB21 for standard applications

Function

Basic functions

The 3RB20/3RB21 solid-state overload relays are designed for:

- Inverse-time delayed protection of loads from overloading
- Inverse-time delayed protection of loads from phase unbalance
- Inverse-time delayed protection of loads from phase failure
- Protection of loads from high-resistance short-circuits (internal ground-fault detection only with 3RB21).

Control circuit

The 3RB20/3RB21 solid-state overload relays have an internal power supply, i. e. no additional supply voltage is required.

Short-circuit protection

Fuses or motor starter protectors must be used for short-circuit protection.

For assignments of the corresponding short-circuit protection devices to the 3RB20/3RB21 solid-state overload relays with/without contactor see "Technical specifications" and Catalog LV 1, "Selection and ordering data".

Trip classes

The 3RB20 solid-state overload relays are available for normal starting conditions with trip CLASS 10 or for heavy starting conditions with trip CLASS 20 (fixed setting in each case).

The 3RB21 solid-state overload relays are suitable for normal and heavy starting conditions. The required trip class (CLASS 5, 10, 20 or 30) can be adjusted by means of a rotary switch depending on the current start-up condition.

For details of the trip classes see "Characteristic Curves".

Phase failure protection

The 3RB20/3RB21 solid-state overload relays are fitted with phase failure protection (see "Characteristic Curves") in order to minimize temperature rises of the load during single-phase operation. Phase failure protection is not effective for loads with star-connection and a grounded neutral point or a neutral point which is connected to a neutral conductor.

Setting

The 3RB20/3RB21 solid-state overload relays are set to the rated motor current by means of a rotary knob. The scale of the rotary knob is shown in ampere.

With the 3RB21 solid-state overload relay it is also possible to select the trip class (CLASS 5, 10, 20 or 30) using a second rotary knob and to switch the internal ground-fault detection on and off.

Manual and automatic reset

In the case of the 3RB20/3RB21 solid-state overload relays, a slide switch can be used to choose between automatic and manual resetting.

If manual reset is set, a reset can be carried out directly on the device after a trip by pressing the blue RESET button. Resetting is possible in combination with mechanical and mechanical reset options from the range of accessories (see Catalog LV 1, "Accessories"). As an alternative to the mechanical RESET options, the 3RB21 solid-state overload relays can be equipped with electrical remote RESET by applying a voltage of 24 V DC to the terminals A3 and A4.

If the slide switch is set to automatic RESET, the relay is reset automatically.

The time between tripping and resetting is determined by the recovery time.

Recovery time

With the 3RB20/3RB21 solid-state overload relays the recovery time after inverse-time delayed tripping is 3 minutes when automatic RESET is set. This recovery time allows the load to cool down.

If the button is set to manual RESET and automatic RESET, the 3RB20/3RB21 devices can be reset immediately after tripping.

TEST function

With motor current flowing, the TEST button can be used to check whether the relay is working correctly (device/solid-state test). Current measurement, motor model and trip unit are tested. If these components are OK, the device is tripped according to the table below. If there is an error, no tripping takes place.

Trip classes	Required loading with the rated current prior to pressing the TEST button	Tripping within
CLASS 5	3 min	30 s
CLASS 10	5 min	1 min
CLASS 20	10 min	2 min
CLASS 30	15 min	3 min

Note: The TEST button must be kept pressed throughout the test. In this case the motor current must be equal to more than 80 % of the current setting I_e and have at least the value of the lower current setting.

Testing of the auxiliary contacts and the control current wiring is possible with the switch position indicator slide. Actuating the slide simulates tripping of the relay. During this simulation the NC contact (95-96) is opened and the NO contact (97-98) is closed. This tests whether the auxiliary circuit has been correctly wired.

After a test trip the relay is reset by pressing the RESET button.

Self-monitoring

The 3RB20/3RB21 solid-state overload relays have a self-monitoring feature, i. e. the devices constantly monitor their own basic functions and trip if an internal fault is detected.

Display of operating state

The respective operating state of the 3RB20/3RB21 solid-state overload relays is displayed by means of the position of the marking on the switch position indicator slide. After tripping due to overload, phase failure, phase unbalance or ground fault (ground-fault detection possible only with 3RB21) the marking on the slide is to left on the "O" mark, otherwise it is on the "I" mark.

Auxiliary contacts


The 3RB20/3RB21 solid-state overload relays are fitted with an NO contact for the "tripped" signal, and an NC contact for switching off the contactor.

Overload Relays

3RB2 Solid-State Overload Relays

3RB20, 3RB21 for standard applications

Technical specifications

Type		3RB20 16, 3RB21 13	3RB20 26, 3RB21 23	3RB20 36, 3RB21 33	3RB20 46, 3RB21 43	3RB20 56, 3RB21 53	3RB20 66, 3RB21 63
Size		S00	S0	S2	S3	S6	S10/S12
Width		45 mm	45 mm	55 mm	70 mm	120 mm	145 mm
General data							
Trips in the event of		Overload, phase failure, and phase unbalance + ground fault (for 3RB21 only)					
Trip class acc. to IEC 60947-4-1	CLASS	10/20/5, 10, 20 and 30 adjustable (depending on the version)					
Phase failure sensitivity		Yes					
Overload warning		No					
Reset and recovery		Manual, automatic and remote RESET (depending on the version)					
• Reset options after tripping							
• Recovery time							
- For automatic RESET	min.	Approx. 3 min					
- For manual RESET	min.	Immediately					
- For remote RESET	min.	Immediately					
Features							
• Display of operating state on device		Yes, by means of switch position indicator slide					
• TEST function		Yes, test of electronics by pressing the TEST button / test of auxiliary contacts and wiring of control circuit by actuating the switch position indicator slide / self-monitoring					
• RESET button		Yes					
• STOP button		No					
Explosion protection – safe operation of motors with "increased safety" type of protection							
EC type test certificate number acc. to directive 94/9/EC (ATEX)		PTB 06 ATEX 3001  II (2) GD					
Ambient temperatures							
• Storage/transport	°C	-40 ... +80					
• Operation	°C	-25 ... +60					
• Temperature compensation	°C	+60					
• Permissible rated current at							
- Temperature inside control cabinet 60 °C, stand-alone installation	%	100	100 ²⁾	100	100	100	100 or 90 ³⁾
- Temperature inside control cabinet 60 °C, mounted on contactor	%	100	100 ²⁾	100	100	70	70
- Temperature inside control cabinet 70 °C	%	1)					
Repeat terminals							
• Coil repeat terminal		Yes	Not required				
• Auxiliary contact repeat terminal		Yes	Not required				
Degree of protection acc. to IEC 60529		IP20		IP20 ⁴⁾			
Touch protection acc. to IEC 61140		Finger-safe				Finger-safe, for busbar connection with cover	Finger-safe with cover
Shock resistance with sine acc. to IEC 60068-2-27		g/ms	15/11 ⁵⁾				
Electromagnetic compatibility (EMC) – Interference immunity							
• Conductor-related interference							
- Burst acc. to IEC 61000-4-4 (corresponds to degree of severity 3)	kV	2 (power ports), 1 (signal ports)					
- Surge acc. to IEC 61000-4-5 (corresponds to degree of severity 3)	kV	2 (line to earth), 1 (line to line)					
• Electrostatic discharge acc. to IEC 61000-4-2 (corresponds to degree of severity 3)	kV	8 (air discharge), 6 (contact discharge)					
• Field-related interference acc. to IEC 61000-4-3 (corresponds to degree of severity 3)	V/m	10					
Electromagnetic compatibility (EMC) – Emitted interference		Degree of severity B acc. to EN 55011 (CISPR 11) and EN 55022 (CISPR 22)					
Resistance to extreme climates – air humidity		%	100				
Dimensions		See dimensional drawings					
Installation altitude above sea level		m	Up to 2000				
Mounting position		Any					
Type of mounting		Direct mounting/stand-alone installation with terminal brack- et		Direct mounting/stand-alone installation			

1) On request.

2) S0 for 6 ... 25 A, CLASS 20, $I_{\text{emax}} = 19 \text{ A}$;
S0 for 6 ... 25 A, CLASS 30, $I_{\text{emax}} = 16 \text{ A}$.

3) 90 % for relay with current setting range 160 ... 630 A.


4) Terminal compartment: degree of protection IP00.

5) Signaling contact 97/98 in position "tripped": 4/11 g/ms.

Overload Relays

3RB2 Solid-State Overload Relays

3RB20, 3RB21 for standard applications

Type		3RB20 16, 3RB21 13	3RB20 26, 3RB21 23	3RB20 36, 3RB21 33	3RB20 46, 3RB21 43
Size		S00	S0	S2	S3
Width		45 mm	45 mm	55 mm	70 mm
Main circuit					
Rated insulation voltage U_i (degree of pollution 3)	V	690		690/1000 ¹⁾	1000
Rated impulse withstand voltage U_{imp}	kV	6		6/8 ²⁾	8
Rated operational voltage U_e	V	690		690/1000 ¹⁾	1000
Type of current		No			
• Direct current		Yes, 50/60 Hz ± 5 %			
• Alternating current					
Current setting	A	0.1 ... 0.4 to 3 ... 12	0.1 ... 0.4 to 6 ... 25	6 ... 25 and 12.5 ... 50	12.5 ... 50 and 25 ... 100
Power loss per unit (max.)	W	0.05			
Short-circuit protection		See Catalog LV 1, "Selection and ordering data"			
• With fuse without contactor		See "Technical specifications" (short-circuit protection with fuses for motor feeders)			
• With fuse and contactor					
Protective separation between main and auxiliary conducting path acc. to IEC 60947-1 (degree of pollution 2)	V	690 ³⁾			
Connection for main circuit					
Connection type		 Screw terminals with box terminal			
• Terminal screw		Pozidriv size 2			Allen screw 4 mm
• Tightening torque	Nm	0.8 ... 1.2	2 ... 2.5	3 ... 4.5	4 ... 6
• Conductor cross-sections (min./max.), 1 or 2 conductors					
- Solid	mm ²	2 × (0.5 ... 1.5) ⁴⁾ 2 × (0.75 ... 2.5) ⁴⁾	2 × (1 ... 2.5) ⁴⁾ 2 × (2.5 ... 6) ⁴⁾	2 × (1 ... 16)	2 × (2.5 ... 16)
- Finely stranded without end sleeve	mm ²	--			
- Finely stranded with end sleeve	mm ²	2 × (0.5 ... 1.5) ⁴⁾ 2 × (0.75 ... 2.5) ⁴⁾	2 × (1 ... 2.5) ⁴⁾ 2 × (2.5 ... 6) ⁴⁾	2 × (1 ... 16) ⁴⁾ 1 × (1 ... 25) ⁴⁾	2 × (2.5 ... 35), 1 × (2.5 ... 50)
- Stranded	mm ²	--		2 × (max. 25), 1 × (1 ... 35)	2 × (10 ... 50), 1 × (10 ... 70)
- AWG cables, solid or stranded	AWG	2 × (18 ... 14)	2 × (14 ... 10)	2 × (max. 4), 1 × (18 ... 2)	2 × (10 ... 1/0), 1 × (10 ... 2/0)
- Ribbon cable conductors (number x width x thickness)	mm	--		2 × (6 × 9 × 0.8)	2 × (6 × 9 × 0.8)
Busbar connections					
• Terminal screw		--			M 6 × 20
• Tightening torque	Nm	--			4 ... 6
• Conductor cross-section (min./max.)					
- Finely stranded with cable lug	mm ²	--			2 × 70
- Stranded with cable lug	mm ²	--			3 × 70
- AWG cable, solid or stranded, with cable lug	AWG	--			2/0
- With connecting bar (max. width)	mm	--			12
Straight-through transformers					
Connection type					
Diameter of opening	mm	--	15	18	

1) For version with straight-through transformer up to 1000 V AC.

2) For version with straight-through transformer up to 8 kV.


3) For grounded networks, otherwise 600 V.

4) If two different conductor cross-sections are connected to one clamping point, both cross-sections must lie in the range specified. If identical cross-sections are used, this restriction does not apply.

Overload Relays

3RB2 Solid-State Overload Relays

3RB20, 3RB21 for standard applications

Type		3RB20 56, 3RB21 53	3RB20 66, 3RB21 63
Size		S6	S10/S12
Width		120 mm	145 mm
Main circuit			
Rated insulation voltage U_i (degree of pollution 3)	V	1000	
Rated impulse withstand voltage U_{imp}	kV	8	
Rated operational voltage U_e	V	1000	
Type of current		No	
• Direct current		No	
• Alternating current		Yes, 50/60 Hz $\pm 5\%$	
Current setting	A	50 ... 200	55 ... 250 to 160 ... 630
Power loss per unit (max.)	W	0.05	
Short-circuit protection		See Catalog LV 1, "Selection and ordering data"	
- With fuse without contactor		See "Technical specifications" (short-circuit protection with fuses for motor feeders)	
- With fuse and contactor			
Protective separation between main and auxiliary conducting path acc. to IEC 60947-1 (degree of pollution 2)	V	690 ¹⁾	
Connection for main circuit			
Connection type		 Screw terminals with box terminal	
• Terminal screw		4 mm Allen screw	5 mm Allen screw
• Tightening torque	Nm	10 ... 12	20 ... 22
• Conductor cross-sections (min./max.), 1 or 2 conductors			
- Solid	mm ²	--	
- Finely stranded without end sleeve	mm ²	With 3RT19 55-4G box terminal: 2 x (1 x max. 50, 1 x max. 70), 1 x (10 ... 70) With 3RT19 56-4G box terminal: 2 x (1 x max. 95, 1 x max. 120), 1 x (10 ... 120)	2 x (50 ... 185), Front clamping point only: 1 x (70 ... 240) Rear clamping point only: 1 x (120 ... 185)
- Finely stranded with end sleeve	mm ²	With 3RT19 55-4G box terminal: 2 x (1 x max. 50, 1 x max. 70), 1 x (10 ... 70) With 3RT19 56-4G box terminal: 2 x (1 x max. 95, 1 x max. 120), 1 x (10 ... 120)	2 x (50 ... 185), Front clamping point only: 1 x (70 ... 240) Rear clamping point only: 1 x (120 ... 185)
- Stranded	mm ²	With 3RT19 55-4G box terminal: 2 x (max. 70), 1 x (16 ... 70) With 3RT19 56-4G box terminal: 2 x (max. 120), 1 x (16 ... 120)	2 x (70 ... 240), Front clamping point only: 1 x (95 ... 300) Rear clamping point only: 1 x (120 ... 240)
- AWG cables, solid or stranded	AWG	With 3RT19 55-4G box terminal: 2 x (max. 1/0), 1 x (6 ... 2/0) With 3RT19 56-4G box terminal: 2 x (max. 3/0), 1 x (6 ... 250 kcmil)	2 x (2/0 ... 500 kcmil), Front clamping point only: 1 x (3/0 ... 600 kcmil) Rear clamping point only: 1 x (250 kcmil ... 500 kcmil)
- Ribbon cable conductors (number x width x thickness)	mm	With 3RT19 55-4G box terminal: 2 x (6 x 15.5 x 0.8), 1 x (3 x 9 x 0.8 ... 6 x 15.5 x 0.8) With 3RT19 56-4G box terminal: 2 x (10 x 15.5 x 0.8), 1 x (3 x 9 x 0.8 ... 10 x 15.5 x 0.8)	2 x (20 x 24 x 0.5), 1 x (6 x 9 x 0.8 ... 20 x 24 x 0.5)
Connection type			
• Terminal screw		Busbar connections	
• Tightening torque	Nm	M 8 x 25 10 ... 14	M 10 x 30 14 ... 24
• Conductor cross-section (min./max.)			
- Finely stranded with cable lug	mm ²	16 ... 95 ²⁾	50 ... 240 ³⁾
- Stranded with cable lug	mm ²	25 ... 120 ²⁾	70 ... 240 ³⁾
- AWG cable, solid or stranded, with cable lug	AWG	4 ... 250 kcmil	2/0 ... 500 kcmil
- With connecting bar (max. width)	mm	15	25
Connection type			
Diameter of opening	mm	24.5	--

1) For grounded networks, otherwise 600 V.



2) When connecting cable lugs according to DIN 46235, use the 3RT19 56-4EA1 terminal cover for conductor cross-sections from 95 mm² to ensure phase spacing.

3) When connecting cable lugs according to DIN 46234 for conductor cross-sections from 240 mm² as well as DIN 46235 for conductor cross-sections from 185 mm², use the 3RT19 56-4EA1 terminal cover to ensure phase spacing.

Overload Relays

3RB2 Solid-State Overload Relays

3RB20, 3RB21 for standard applications

Type		3RB20 16, 3RB21 13	3RB20 26, 3RB21 23	3RB20 36, 3RB21 33	3RB20 46, 3RB21 43	3RB20 56, 3RB21 53	3RB20 66, 3RB21 63
Size		S00	S0	S2	S3	S6	S10/S12
Width		45 mm	45 mm	55 mm	70 mm	120 mm	145 mm
Auxiliary circuit							
Number of NO contacts		1					
Number of NC contacts		1					
Auxiliary contacts – assignment		1 NO for the signal "tripped", 1 NC for disconnecting the contactor					
Rated insulation voltage U_i (degree of pollution 3)		V	300				
Rated impulse withstand voltage U_{imp}		kV	4				
Auxiliary contacts – contact rating							
• NC contact with alternating current AC-14/AC-15 Rated operational current I_e at U_e :							
- 24 V		A	4				
- 120 V		A	4				
- 125 V		A	4				
- 250 V		A	3				
• NO contact with alternating current AC-14/AC-15: Rated operational current I_e at U_e :							
- 24 V		A	4				
- 120 V		A	4				
- 125 V		A	4				
- 250 V		A	3				
• NC, NO contact with direct current DC-13: Rated operational current I_e at U_e :							
- 24 V		A	2				
- 60 V		A	0.55				
- 110 V		A	0.3				
- 125 V		A	0.3				
- 250 V		A	0.11				
• Conventional thermal current I_{th}		A	5				
• Contact reliability (suitability for PLC control; 17 V, 5 mA)			Yes				
Short-circuit protection							
• With fuse, gL/gG operational class		A	6				
Ground-fault protection (only 3RB21)		The information refers to sinusoidal residual currents at 50/60 Hz					
• Tripping value I_{Δ}		> $0.75 \times I_{motor}$					
• Operating range I		Lower current setting value < I_{motor} < $3.5 \times$ upper current setting value					
• Response time t_{trip} (in steady-state condition)		s	< 1				
Integrated electrical remote reset (only 3RB21)							
Connecting terminals A3, A4		24 V DC, 100 mA, 2.4 W short-term					
Protective separation between main and auxiliary con- ducting path acc. to IEC 60947-1		V	300				
CSA, UL, UR rated data							
Auxiliary circuit – switching capacity		B300, R300					
Connection of the auxiliary circuit							
Connection type		 Screw terminals					
• Terminal screw		Pozidriv size 2					
• Tightening torque		Nm	0.8 ... 1.2				
• Conductor cross-sections (min./max.), 1 or 2 conductors							
- Solid		mm ²	1 × (0.5 ... 4), 2 × (0.5 ... 2.5)				
- Finely stranded without end sleeve		mm ²	–				
- Finely stranded with end sleeve		mm ²	1 × (0.5 ... 2.5), 2 × (0.5 ... 1.5)				
- Stranded		mm ²	–				
- AWG cables, solid or stranded		AWG	2 × (20 ... 14)				
Connection type		 Spring-type terminals					
• Conductor cross-sections (min./max.), 1 or 2 conductors							
- Solid		mm ²	2 × (0.25 ... 1.5)				
- Finely stranded without end sleeve		mm ²	–				
- Finely stranded with end sleeve		mm ²	2 × (0.25 ... 1.5)				
- Stranded		mm ²	2 × (0.25 ... 1.5)				
- AWG cables, solid or stranded		AWG	2 × (24 ... 16)				

Footnotes for page 25:

- Please observe operational voltage.
- Type of coordination and short-circuit protective devices acc. to IEC 60947-4-1:
Type of coordination "1": The contactor or the starter may be non-operational after every short-circuit release.
Type of coordination "2": The contactor or the starter must be operational after a release (without replacement of parts). There is a risk of contact welding.
- $U_e = 500$ V.
- Contactor cannot be mounted.
- Please ensure that the maximum AC-3 operational current has sufficient safety clearance from the rated current of the fuses.
- With 3UF18 68-3GA00 current transformer.

Overload Relays

3RB2 Solid-State Overload Relays

3RB20, 3RB21 for standard applications

Short-circuit protection with fuses for motor feeders

For short-circuit currents up to 50 kA or 100 kA
at rated operational voltages up to 690 V

Overload relays	Contactors	CLASS 5 and 10			CLASS 20			CLASS 30			690 V/ 50 kA	690 V/ 100 kA		690 V/ 50 kA	415 V/ 50 kA	600 V/ SSCR	
											Fuse links ¹⁾			Fuses ¹⁾	Acc. to BS 88	Listed acc. to UL, RK5 CL. L	
											LV HRC	Type 3NA	Type 3ND				
											DIAZED	Type 3SB	Type 3SE				
											Operational class gG		aM				
Setting range	Type	Rated operational current I _e /AC-3 in A at ... V									Rated operational current I _e /AC-3 in A for type of coordination ²⁾						
A		400	500	690	400	500	690	400	500	690	1	2	1	2	2	2	--
Size S00																	
0.1 ... 0.4	3RT10 15	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	35	1 ³⁾	20	1 ³⁾	--	--	1.6
0.32 ... 1.25	3RT10 15	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	35	2	20	2	--	2	5
1 ... 4	3RT10 15	4	4	4	4	4	4	4	4	4	35	10	20	10	--	10	15
	3RT10 16	4	4	4	4	4	4	4	4	4	35	10	20	10	--	10	15
	3RT10 17	4	4	4	4	4	4	4	4	4	35	10	20	10	--	10	15
3 ... 12	3RT10 16	9	6.5	5.2	9	6.5	5.2	9	6.5	5.2	35	20	20	20	--	20	45
	3RT10 17	12	9	6.3	10	9	6.3	9	9	6.3	35	20	20	20	--	20	45
Size S0																	
0.1 ... 0.4	3RT10 23	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	35	1 ³⁾	20	1 ³⁾	--	--	1.6
0.32 ... 1.25	3RT10 23	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	35	2	20	2	--	2	5
1 ... 4	3RT10 23	4	4	4	4	4	4	--	--	--	63	10	20	10	--	10	15
	3RT10 24	4	4	4	4	4	4	4	4	4	63	10	25	10	--	10	15
3 ... 12	3RT10 23	9	6.5	5.2	9	6.5	5.2	--	--	--	63	25	20	20	--	20	45
	3RT10 24	12	12	9	12	12	9	12	12	9	63	25	25	20	20	20	45
	3RT10 25	12	12	12	12	12	12	12	12	12	63	25	25	20	20	20	45
6 ... 25	3RT10 24	12	12	9	12	12	9	12	12	9	63	25	25	25	20	25	70
	3RT10 25	17	17	13	16	16	13	14	14	13	63	25	25	25	20	25	70
	3RT10 26	25	18	13	16	16	13	14	14	13	100	35	35	35	20	25	100
Size S2																	
6 ... 25	3RT10 34	25	25	20	22.3	22.3	20	19.1	19.1	19.1	125	63	63	63	50	63	100
	3RT10 35	25	25	24	25	25	24	25	25	24	125	63	63	63	50	80	100
12.5 ... 50	3RT10 34	32	32	20	22.3	22.3	20	19.1	19.1	19.1	125	63	63	63	50	63	125
	3RT10 35	40	40	24	29.4	29.4	24	26.5	26.5	24	125	63	63	63	50	80	150
	3RT10 36	50	50	24	32.7	32.7	24	26.5	26.5	24	160	80	80	80	50	80	200
Size S3																	
12.5 ... 50	3RT10 44	50	50	47	49	49	47	41.7	41.7	41.7	200	125	125	125	63	125	200
	3RT10 45	50	50	50	50	50	50	45	45	45	200	160	160	160	80	160	200
25 ... 100	3RT10 44	65	65	47	49	49	47	41.7	41.7	41.7	200	125	125	125	63	125	250
	3RT10 45	80	80	58	53	53	53	45	45	45	200	160	160	160	80	160	300
	3RT10 46	95	95	58	59	59	58	50	50	50	200	160	160	160	100	160	350
	3RT10 54	100	100	100	81.7	81.7	81.7	69	69	69	355	315	315	315	160	250	400
	3RT10 55	--	--	--	100	100	100	90	90	90	355	315	315	315	200	315	400
Size S6																	
50 ... 200	3RT10 54	115	115	115	81.7	81.7	81.7	69	69	69	355	315	315	315	160	250	450
	3RT10 55	150	150	150	107	107	107	90	90	90	355	315	315	315	200	315	500
	3RT10 56	185	185	170	131	131	131	111	111	111	355	315	315	315	200	315	500
Size S10																	
55 ... 250	3RT10 64	225	225	225	160	160	160	135	135	135	500	400	400	400	250	400	600
	3RT10 65	250	250	250	188	188	188	159	159	159	500	400	400	400	315	400	700
	3RT10 66	250	250	250	213	213	213	180	180	180	500	400	400	400	315	400	700
Size S12																	
160 ... 630	3RT10 64	225	225	225	160	160	160	--	--	--	500	400	400	400	250	400	600
	3RT10 65	265	265	265	188	188	188	--	--	--	500	400	400	400	315	400	700
	3RT10 66	300	300	280	213	213	213	180	180	180	500	400	400	400	315	400	800
	3RT10 75	400	400	400	284	284	284	240	240	240	630	500	500	500	400	450	1000
	3RT10 76	500	500	450	355	355	355	300	300	300	630	500	500	500	500	500	1200
	3RT12 64	225	225	225	225	225	225	173	173	173	500	500	500	500	400	450	600
	3RT12 65	265	265	265	265	265	265	204	204	204	500	500	500	500	400	450	700
	3RT12 66	300	300	300	300	300	300	231	231	231	500	500	500	500	400	450	800
	3RT12 75	400	400	400	400	400	400	316	316	316	800	800	800	--	630	800	1000
	3RT12 76	500	500	500	500	500	500	385	385	385	800	800	800	--	630	800	1200
	3TF68 ⁴⁾	630	630	630	440	440	440	376	376	376	800	500 ⁵⁾	500 ⁵⁾	500 ⁵⁾	630	500	1600
	3TF69 ⁴⁾	630	630	630	572	572	572	500	500	500	800	630 ⁵⁾	630 ⁵⁾	--	630	630	1600
Size 14																	
0.32 ... 1.25 ⁶⁾	3TF69 ⁴⁾	820	820	820	572	572	572	500	500	500	800	630 ⁵⁾	630 ⁵⁾	--	630	630	1600

For footnotes see page 24.

SSCR = Standard Short-Circuit Rating

Overload Relays

3RB2 Solid-State Overload Relays

3RB20, 3RB21 for standard applications

Characteristic curves

The tripping characteristics show the relationship between the tripping time and tripping current as multiples of the current setting I_e and are given for symmetrical three-pole and two-pole loads from the cold state.

The smallest current used for tripping is called the minimum tripping current. According to IEC 60947-4-1, this current must be within specified limits. The limits of the total tripping current for the 3RB20/3RB21 solid-state overload relays for symmetrical three-pole loads are between 105 and 120 % of the current setting.

The tripping characteristic starts with the minimum tripping current and continues with higher tripping currents based on the characteristics of the so-called trip classes (CLASS 10, CLASS 20 etc.). The trip classes describe time intervals within which the overload relays have to trip with 7.2 times the current setting I_e from the cold state for symmetrical three-pole loads.

The tripping times according to IEC 60947-4-1, tolerance band E, are as follows for:

Trip class	Tripping time
CLASS 5	3 ... 5 s
CLASS 10	5 ... 10 s
CLASS 20	10 ... 20 s
CLASS 30	20 ... 30 s

The tripping characteristic for a three-pole overload relay from the cold state (see illustration 1) only apply if all three phases are simultaneously loaded with the same current. In the event of a phase failure the 3RB20/3RB21 solid-state overload relays switch off the contactor more quickly in order to minimize heating of the load in accordance with the tripping characteristic for two-pole loads from the cold state (see illustration 2). With phase unbalance the devices switch off depending on the degree of the unbalance between the two characteristic curves.

Compared with a cold load, a load at operating temperature obviously has a lower temperature reserve. The tripping time of the 3RB20/3RB21 solid-state overload relays is reduced therefore to about 20 % when loaded with the current setting I_e for an extended period.

Tripping characteristics for 3-pole loads

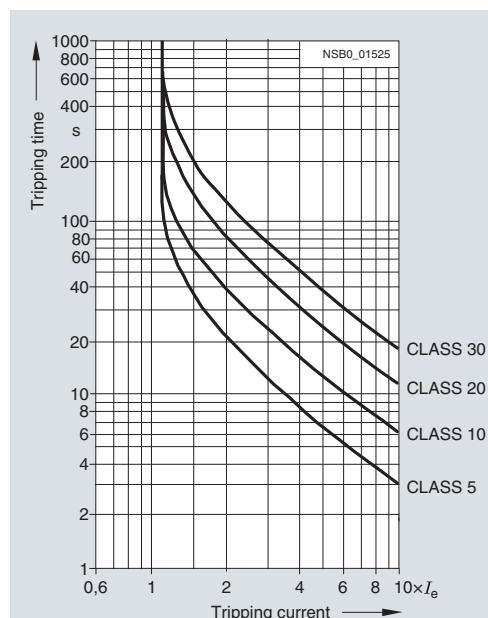


Illustration 1

Tripping characteristics for 2-pole loads

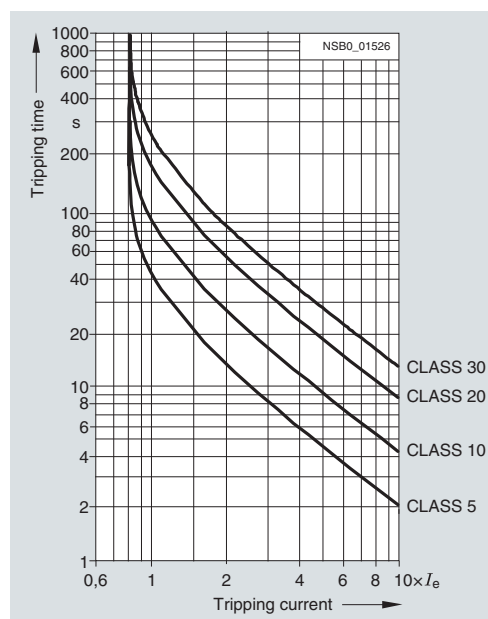


Illustration 2

The above illustrations are schematic representations of characteristic curves. The characteristic curves of the individual 3RB20/3RB21 electronic overload relays can be ordered from "Technical Assistance":

- Either by e-mail to: technical-assistance@siemens.com
- Or on the Internet at: <http://www.siemens.com/automation/service&support>

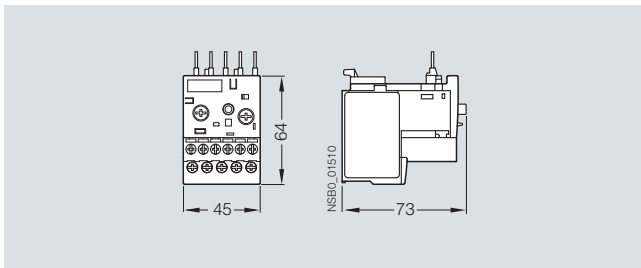
Overload Relays

3RB2 Solid-State Overload Relays

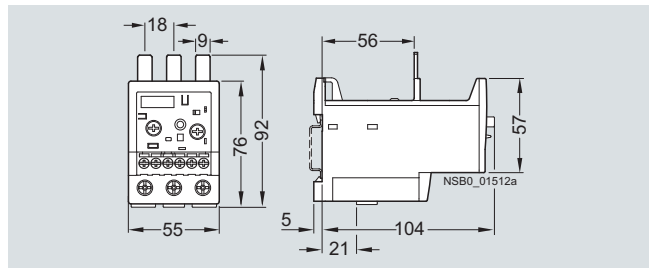
3RB20, 3RB21 for standard applications

Dimensional drawings

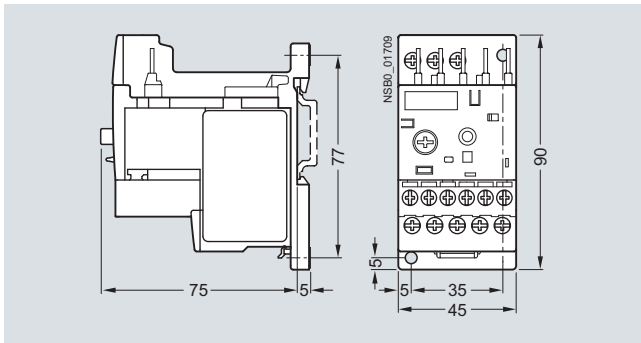
3RB20 16, 3RB21 13, size S00



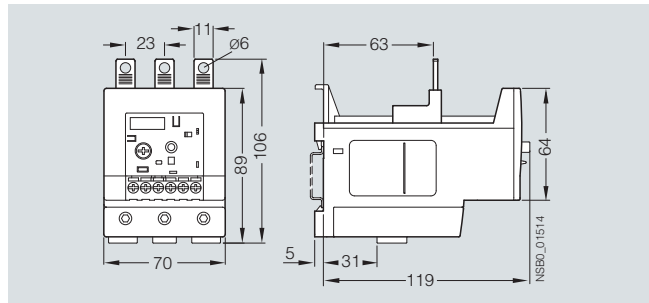
3RB20 36, 3RB21 33, size S2



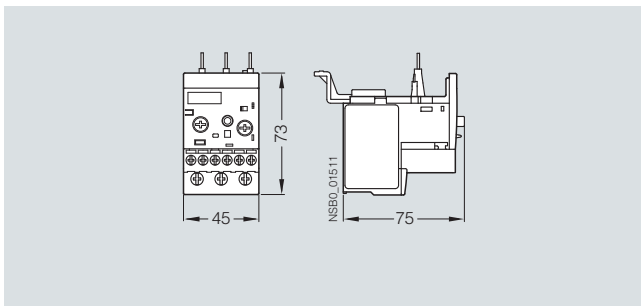
3RB20 16, 3RB21 13, size S00, stand-alone installation



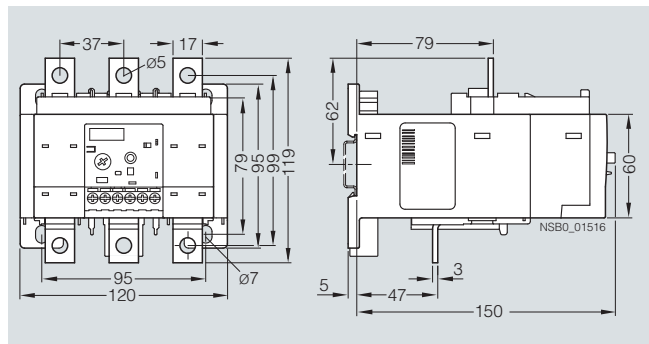
3RB20 46, 3RB21 43, size S3



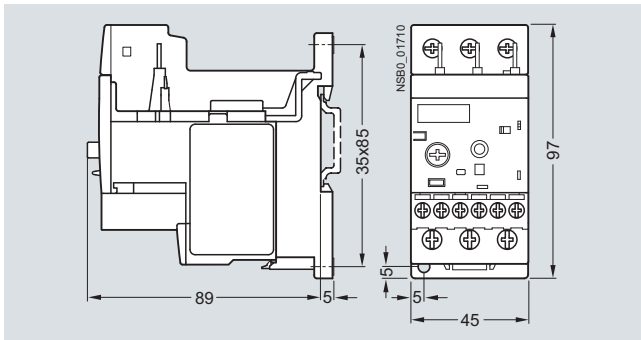
3RB20 26, 3RB21 23, size S0



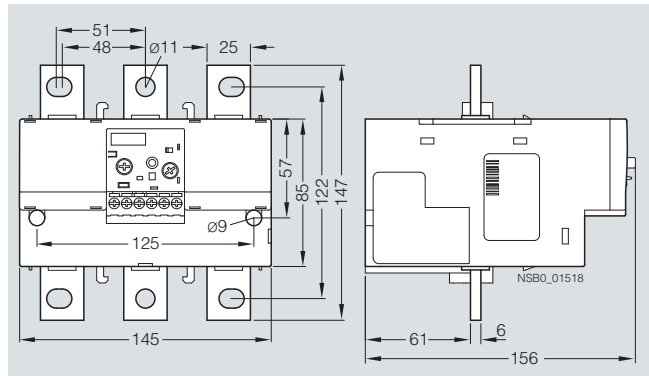
3RB20 56, 3RB21 53, size S6



3RB20 26, 3RB21 23, size S0, stand-alone installation



3RB20 66, 3RB21 63, size S10/S12

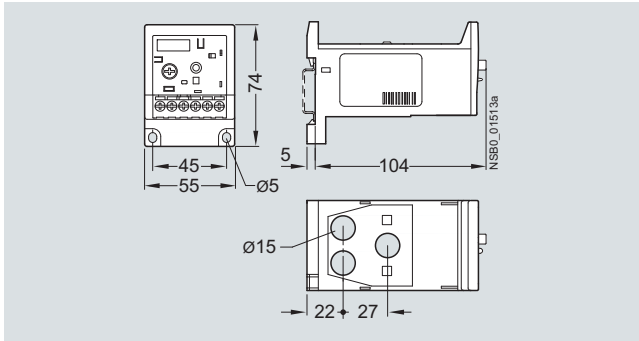


Overload Relays

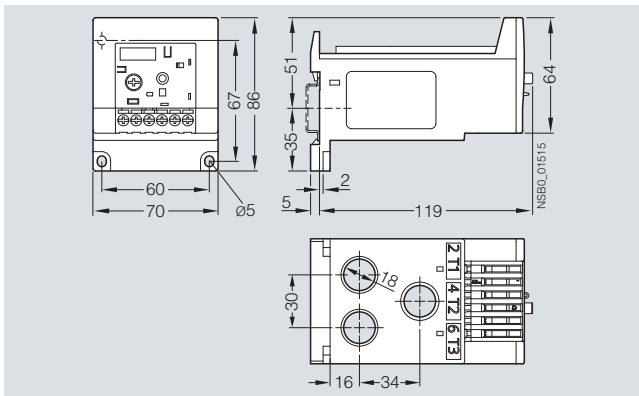
3RB2 Solid-State Overload Relays

3RB20, 3RB21 for standard applications

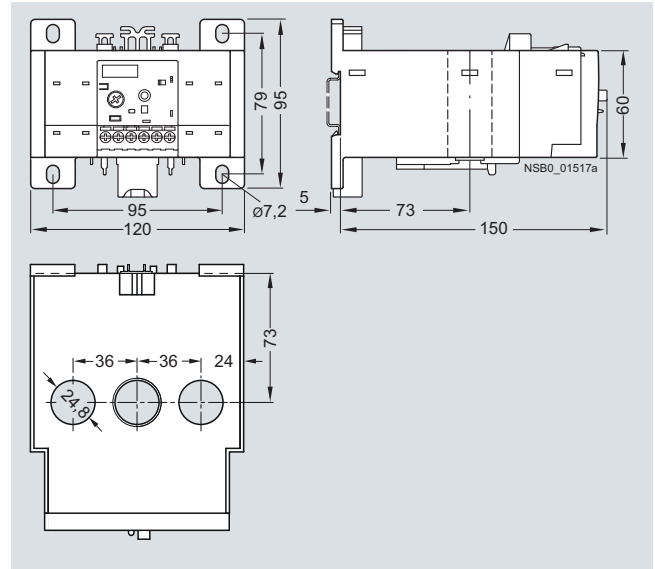
3RB20 36, 3RB21 33, size S2 with straight-through transformer



3RB20 46, 3RB21 43, size S3 with straight-through transformer

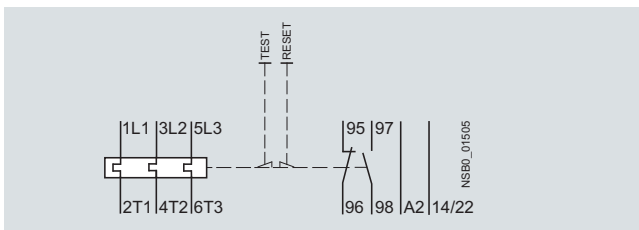


3RB20 56, 3RB21 53, size S6 with straight-through transformer

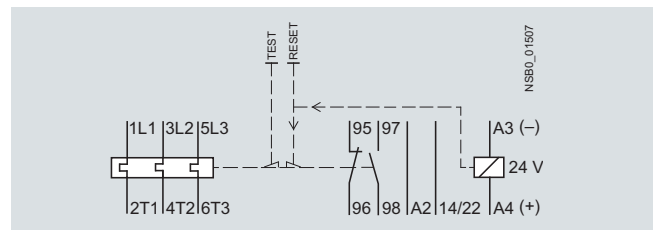


Schematics

3RB20 16



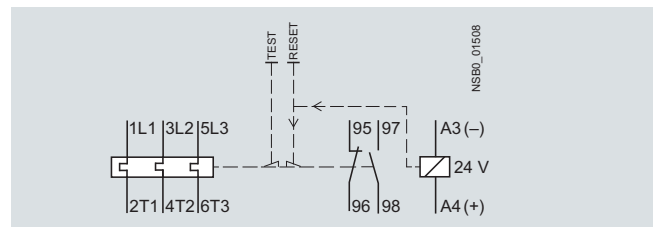
3RB21 13



3RB20 26 to 3RB20 66



3RB21 23 to 3RB21 63

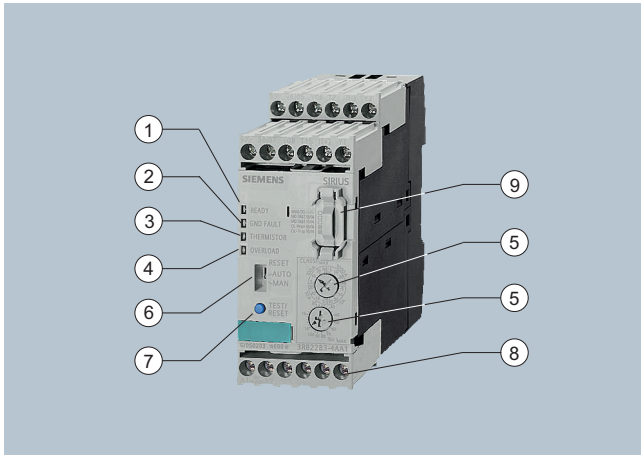


Overload Relays

3RB2 Solid-State Overload Relays

3RB22, 3RB23 for high-feature applications

Overview



3RB22/3RB23 evaluation module

- (1) Green "READY" LED:
A continuous green light signals that the device is working correctly.
- (2) Red "GND FAULT" LED
A continuous red light signals a ground-fault tripping.
- (3) Red "THERMISTOR" LED:
A continuous red light signals an active thermistor trip.
- (4) Red "OVERLOAD" LED:
A continuous red light signals an active overload trip; a flickering red light signals an imminent trip (overload warning).
- (5) Motor current and trip class setting:
Setting the device to the motor current and to the required trip class dependent on the start-up conditions is easy with the two rotary switches.
- (6) Selector switch for manual/automatic RESET:
With this switch you can choose between manual and automatic RESET.
- (7) TEST/RESET button:
Enables testing of all important device components and functions, plus resetting of the device after a trip when manual RESET is selected.
- (8) Connecting terminals (removable joint block):
The generously sized terminals permit connection of two conductors with different cross-sections for the auxiliary, control and sensor circuits. Connection is possible with screw connection and alternatively with spring-type connection.
- (9) 3RB29 85 function expansion module:
Enables more functions to be added, e. g. internal ground-fault detection and/or an analog output with corresponding signals.



3RB29 06 current measuring module

The modular, solid-state overload relays with external power supply type 3RB22 (with monostable auxiliary contacts) and type 3RB23 (with bistable auxiliary contacts) up to 630 A (up to 820 A possible with a series transformer) have been designed for inverse-time delayed protection of loads with normal and heavy starting (see "Function") against excessive temperature rises due to overload, phase unbalance or phase failure. An overload, phase unbalance or phase failure result in an increase of the motor current beyond the set rated motor current. This current rise is detected by means of a current measuring module and electronically evaluated by a special evaluation module which is connected to it. The evaluation electronics sends a signal to the auxiliary contacts. The auxiliary contacts then switch off the load by means of a contactor. The break time depends on the ratio between the tripping current and current setting I_e and is stored in the form of a long-term stable tripping characteristic (see "Characteristic Curves"). The "tripped" status is signaled by means of a continuous red "OVERLOAD" LED.

The LED indicates imminent tripping of the relay due to overload, phase unbalance or phase failure by flickering when the limit current has been violated. This warning can also be issued as a signal through auxiliary contacts.

In addition to the described inverse-time delayed protection of loads against excessive temperature rises, the 3RB22/3RB23 solid-state overload relays also allow direct temperature monitoring of the motor windings (full motor protection) by connection with short-circuit and open-circuit detection of a PTC sensor circuit. With this temperature-dependent protection, the loads can be protected against overheating caused indirectly by reduced coolant flow, for example, which cannot be detected by means of the current alone. In the event of overheating, the devices switch off the contactor, and thus the load, by means of the auxiliary contacts. The "tripped" status is signaled by means of a continuously illuminated "THERMISTOR" LED.

To also protect the loads against high-resistance short-circuits due to damage to the insulation, humidity, condensed water, etc., the 3RB22/3RB23 solid-state overload relays offer the possibility of internal ground-fault detection in conjunction with a function expansion module (for details see Catalog LV 1, "Selection and ordering data"; not possible in conjunction with contactor assembly for wye-delta starting). In the event of a ground fault the 3RB22/3RB23 relays trip. The "tripped" status is signaled by means of a continuous red "GND FAULT" LED. Signaling through auxiliary contacts is also possible.

After tripping due to overload, phase unbalance, phase failure, thermistor or ground-fault tripping, the relay is reset manually or automatically after the recovery time has elapsed (see "Function").

In conjunction with a function expansion module the motor current measured by the microprocessor can be output in the form of an analog signal 4 ... 20 mA DC for operating rotary coil instruments or for feeding into analog inputs of programmable logic controllers. With an additional AS-Interface analog module the current values can also be transferred over the AS-i bus system.

The devices are manufactured in accordance with environmental guidelines and contain environmentally friendly and reusable materials.

They comply with all important worldwide standards and approvals.

Overload Relays

3RB2 Solid-State Overload Relays

3RB22, 3RB23 for high-feature applications

"Increased safety" type of protection EEx e acc. to ATEX directive 94/9/EC

The 3RB22 (monostable) solid-state overload relays are suitable for the overload protection of explosion-proof motors with "increased safety" type of protection EEx e;

see Catalog LV 1, Chapter 20 "Appendix" --> "Standards and Approvals" --> "Type Overview of Approved Devices for Explosion-Protected Areas (ATEX Explosion Protection)".

Design

Device concept

The 3RB22/3RB23 solid-state overload relays are based on a modular device concept. Each device always comprises an evaluation module, which is independent of the motor current, and a current measuring module, which is dependent on the motor current. The two modules are electrically interconnected by a connection cable through the system interface.

The basic functionality of the evaluation module can be optionally expanded with corresponding function expansion modules. The function expansion modules are integrated in the evaluation module for this purpose through a simple plug-in connection.

Mounting options

Current measuring modules

The current measuring modules size S00/S0 and S2/S3 are designed for stand-alone installation. By contrast, the current measuring modules size S6 and S10/S12 are suitable for stand-alone installation and mounting onto contactors.

Evaluation modules

The evaluation modules can be mounted either on the current measuring module (only sizes S00/S0 and S2/S3) or separately.

For more information on the mounting options see "Technical specifications" and Catalog LV 1, "Selection and ordering data".

Connection methods

Main circuit (current measuring module)

For sizes S00/S0, S2/S3 and S6, the main circuit can also be connected by the straight-through transformer method. In this case, the cables of the main circuit are routed directly through the feed-through openings of the relay to the contactor terminals.

For sizes S6 and S10/S12, the main circuit can be connected with the help of rails. In conjunction with the corresponding box terminals, screw connection is also possible.

Auxiliary circuit (evaluation module)

Connection of the auxiliary circuit (removable joint block) is possible with either screw or spring-type terminal connection system (special versions).

For more information on the connection options see "Technical specifications" and Catalog LV 1, "Selection and ordering data".

Overload relays in contactor assemblies for wye-delta starting

When overload relays are used in combination with contactor assemblies for wye-delta starting it must be noted that only 0.58 times the motor current flows through the line contactor. An overload relay mounted onto the line contactor must be set to 0.58 times the motor current.

When 3RB22/3RB23 solid-state overload relays are used in combination with contactor assemblies for wye-delta starting, the function expansion modules for internal ground-fault detection must not be used.

Operation with frequency converter

The 3RB22/3RB23 solid-state overload relays are suitable for frequencies of 50/60 Hz and the associated harmonics. This permits the 3RB22/3RB23 overload relays to be used on the input side of the frequency converter.

If motor protection is required on the outgoing side of the frequency converter, Siemens recommends the 3RN thermistor motor protection devices or the 3RU11 thermal overload relays for this purpose.

Overload Relays

3RB2 Solid-State Overload Relays

3RB22, 3RB23 for high-feature applications

Function

Basic functions

The 3RB22/3RB23 solid-state overload relays are designed for:

- Inverse-time delayed protection of loads from overloading
- Inverse-time delayed protection of loads from phase unbalance
- Inverse-time delayed protection of loads from phase failure
- Temperature-dependent protection of loads by connecting a PTC sensor circuit
- Protection of loads from high-resistance short-circuits (internal ground-fault detection; detection of fault currents > 30 % of the current setting I_e)
- Output of an overload warning
- Output of an analog signal 4 to 20 mA DC as image of the flowing motor current

The basic functions of the evaluation modules in conjunction with function expansion modules are listed in the following table:

Evaluation modules	Function expansion modules	Basic functions
3RB22 83-4AA1 3RB22 83-4AC1 3RB23 83-4AA1 3RB23 83-4AC1	None	Inverse-time delayed protection, temperature-dependent protection, electrical remote RESET, overload warning
	3RB29 85-2CA1	Inverse-time delayed protection, temperature-dependent protection, internal ground-fault detection, electrical remote RESET, overload warning
	3RB29 85-2CB1	Inverse-time delayed protection, temperature-dependent protection, internal ground-fault detection, electrical remote RESET, ground-fault signal
	3RB29 85-2AA0	Inverse-time delayed protection, temperature-dependent protection, electrical remote RESET, overload warning, analog output
	3RB29 85-2AA1	Inverse-time delayed protection, temperature-dependent protection, internal ground-fault detection, electrical remote RESET, overload warning, analog output
	3RB29 85-2AB1	Inverse-time delayed protection, temperature-dependent protection, internal ground-fault detection, electrical remote RESET, ground-fault signal, analog output

Control circuit

The 3RB22/3RB23 solid-state overload relays require an external power supply, i. e. an additional supply voltage is necessary. Power is supplied through a wide-range power supply unit for 24 to 240 V AC/DC.

Short-circuit protection

Fuses or motor starter protectors must be used for short-circuit protection.

For assignments of the corresponding short-circuit protection devices to the 3RB22/3RB23 solid-state overload relays with/without contactor see "Technical specifications" and Catalog LV 1, "Selection and ordering data".

Trip classes

The 3RB22/3RB23 solid-state overload relays are suitable for normal and heavy starting conditions. The required trip class (CLASS 5, 10, 20 or 30) can be adjusted by means of a rotary switch depending on the current start-up condition.

For details of the trip classes see "Characteristic Curves".

Phase failure protection

The 3RB22/3RB23 solid-state overload relays are fitted with phase failure protection (see "Characteristic Curves") in order to minimize temperature rises of the load during single-phase operation.

Setting

The 3RB22/3RB23 solid-state overload relays are set to the rated motor current by means of two rotary knobs.

- The upper rotary knob (CLASS/ I_{emax}) is divided into 4 ranges: 1 A, 10 A, 100 A and 1000 A. The zone must be selected which corresponds to the rated motor current and the current measuring module to be used with it. With the range selected the required trip class (CLASS 5, 10, 20 or 30) can be determined.
- The lower rotary knob with percent scale (10 ... 100 %) is then used to set the rated motor current in percent of the range selected with the upper rotary knob.

Example

- Rating of induction motor = 45 kW (AC 50 Hz, 400 V)
- Rated motor current = 80 A
- Required trip class = CLASS 20
- Selected transformer: 10 ... 100 A

Solution

- Step 1: Use the upper rotary knob (CLASS) to select the 100 A range
- Step 2: Within the 100 A range set the trip class CLASS 20
- Step 3: Set the lower rotary knob to 80 % (= 0.8) corresponding to $100 \text{ A} \times 0.8 = 80 \text{ A}$.

If the current which is set on the evaluation module does not correspond to the current range of the connected current transformer, an error will result.

Manual and automatic reset

In the case of the 3RB22/3RB23 solid-state overload relays, a slide switch can be used to choose between automatic and manual resetting.

If manual reset is set, a reset can be carried out directly on the device after a trip by pressing the blue TEST/RESET button. A remote RESET can be carried out electrically by jumpering the terminals Y1 and Y2.

If the slide switch is set to automatic RESET, the relay is reset automatically.

The time between tripping and resetting is determined by the recovery time.

Overload Relays

3RB2 Solid-State Overload Relays

3RB22, 3RB23 for high-feature applications

Recovery time

With the 3RB22/3RB23 solid-state overload relays the recovery time after inverse-time delayed tripping is approx. 3 minutes regardless of the selected reset mode. The recovery time allows the load to cool down.

However, in the event of temperature-dependent tripping by means of a connected PTC sensor circuit, the device can only be manually or automatically reset once the winding temperature at the installation location of the PTC thermistor has fallen 5 Kelvin below its response temperature.

After a ground-fault tripping the 3RB22/3RB23 solid-state overload relay trips can be reset immediately without a recovery time.

TEST function

The combined TEST/RESET button can be used to check whether the relay is working correctly. The test can be aborted at any time by letting go of the TEST/RESET button.

LEDs, the device configuration (this depends on which expansion module is plugged in) and the device hardware are tested while the button is kept pressed for 6 seconds. Simultaneously and for another 18 seconds a direct current proportional in size to the maximum phase of the main current is fed in at the terminals I(+) and I(-). By comparing the analog signal, which is to be measured, with the main current, the accuracy of the current measurement can be determined. In this case 4 mA corresponds to 0 % and 20 mA to 125 % of the current setting. After 24 seconds the auxiliary contacts are switched and the feeder switch off as the result, bringing the test to an end.

After a test trip a faultless relay is reset by pressing the TEST/RESET button. If a hardware fault is detected, the device trips and cannot be reset.

Self-monitoring

The 3RB22/3RB23 solid-state overload relays have a self-monitoring feature, i. e. the devices constantly monitor their own basic functions and trip if an internal fault is detected.

Display of the operating state

The particular operating state of the 3RB22/3RB23 solid-state overload relays is displayed by means of four LEDs:

- Green "READY" LED: A continuous green light signals that the overload relay is ready for operation. The 3RB22/3RB23 overload relays are not ready (LED "OFF") if there is no control supply voltage or if the function test was negative.
- Red "GND FAULT" LED: A continuous red light signals a ground fault.
- Red "THERMISTOR" LED: A continuous red light signals a temperature-dependent trip.
- Red "OVERLOAD" LED: A continuous red light signals an inverse-time delayed trip; a flickering red light signals an imminent inverse-time delayed trip (overload warning).

Auxiliary contacts

The 3RB22/3RB23 solid-state overload relays have two outputs, each with one NO contact and one NC contact. Their basic assignment/function may be influenced by function expansion modules.

The 3RB22 and 3RB23 differ with respect to the tripping characteristics of their auxiliary contacts – monostable or bistable:

The monostable 3RB22 solid-state overload relays will enter the "tripped" state if the control voltage fails (> 200 ms), and return to the original state they were in before the control supply voltage failed when the voltage returns. These devices are therefore especially suited for plants in which the control voltage is not strictly monitored.

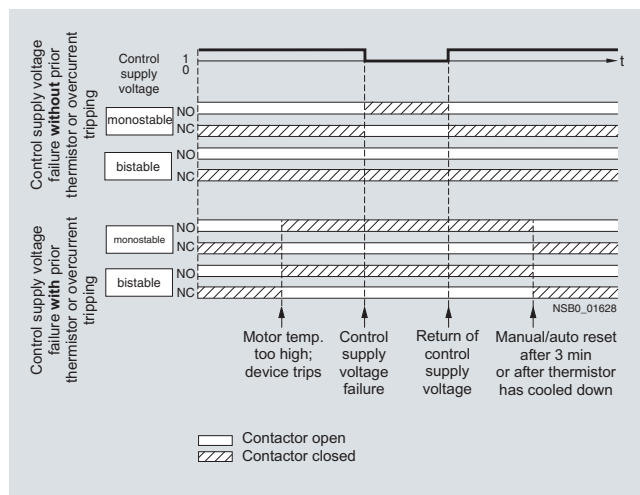
The bistable 3RB23 overload relays do not change their "tripped" or "not tripped" status if the control voltage fails. The auxiliary contacts only switch over in the event of an overload and if the supply voltage is present. These devices are therefore especially suited for plants in which the control voltage is monitored separately.

Response if the control supply voltage fails

If the control supply voltage fails for more than 0.2 s, the output relays respond differently depending on the version: monostable or bistable.

Response of the output relays in the event of	Monostable 3RB22	Bistable 3RB23
Failure of the control supply voltage	The device trips	No change of the switching state of the auxiliary contacts
Return of the control supply voltage without previous tripping	The device resets	No change of the switching state of the auxiliary contacts
Return of the control supply voltage after previous tripping	The device remains tripped Reset: • For overload tripping, after 3 minutes • For thermistor tripping, after the temperature has fallen 5 K below the response temperature • For ground-fault tripping, immediately	The device remains tripped Reset: • For overload tripping, after 3 minutes • For thermistor tripping, after the temperature has fallen 5 K below the response temperature • For ground-fault tripping, immediately

Monostable and bistable responses of the output relays




3RB22, 3RB23 for high-feature applications

- 1) On request.
- 2) Current measuring modules size S6 and S10/S12 with busbar connection in conjunction with cover.

Overload Relays

3RB2 Solid-State Overload Relays

3RB22, 3RB23 for high-feature applications

Type – Overload relay of current measuring module		3RB29 06	3RB29 06	3RB29 56	3RB29 66
Size		S00/S0	S2/S3	S6	S10/S12
Width		45 mm	55 mm	120 mm	145 mm
Main circuit					
Rated insulation voltage U_i (degree of pollution 3)	V	1000			
Rated impulse withstand voltage U_{imp}	kV	6		8	
Rated operational voltage U_e	V	1000			
Type of current		No Yes, 50/60 Hz $\pm 5\%$			
• Direct current					
• Alternating current					
Current setting	A	0.3 ... 3; 2.4 ... 25	10 ... 100	20 ... 200	63 ... 630
Power loss per unit (max.)	W	0.5			
Short-circuit protection		See Catalog LV 1, "Selection and ordering data". See "Technical specifications" (short-circuit protection with fuses for motor feeders)			
• With fuse without contactor					
• With fuse and contactor					
Protective separation between main and auxiliary conducting path acc. to IEC 60947-1 (degree of pollution 2)	V	690 ¹⁾			
Connection for main circuit					
Connection type		 Screw terminals with box terminal			
• Terminal screw		--		4 mm Allen screw	5 mm Allen screw
• Tightening torque	Nm	--		10 ... 12	20 ... 22
• Conductor cross-sections (min./max.), 1 or 2 conductors					
- Solid	mm ²	--		--	--
- Finely stranded without end sleeve	mm ²	--		With 3RT19 55-4G box terminal: 2 × (1 × max. 50, 1 × max. 70), 1 × (10 ... 70) With 3RT19 56-4G box terminal: 2 × (1 × max. 95, 1 × max. 120), 1 × (10 ... 120)	2 × (50 ... 185), Front clamping point only: 1 × (70 ... 240) Rear clamping point only: 1 × (120 ... 185)
- Finely stranded with end sleeve	mm ²	--		With 3RT19 55-4G box terminal: 2 × (1 × max. 50, 1 × max. 70), 1 × (10 ... 70) With 3RT19 56-4G box terminal: 2 × (1 × max. 95, 1 × max. 120), 1 × (10 ... 120)	2 × (50 ... 185), Front clamping point only: 1 × (70 ... 240) Rear clamping point only: 1 × (120 ... 185)
- Stranded	mm ²	--		With 3RT19 55-4G box terminal: 2 × (max. 70), 1 × (16 ... 70) With 3RT19 56-4G box terminal: 2 × (max. 120), 1 × (16 ... 120)	2 × (70 ... 240), Front clamping point only: 1 × (95 ... 300) Rear clamping point only: 1 × (120 ... 240)
- AWG cables, solid or stranded	AWG	--		With 3RT19 55-4G box terminal: 2 × (max. 1/0), 1 × (6 ... 2/0) With 3RT19 56-4G box terminal: 2 × (max. 3/0), 1 × (6 ... 250 kcmil)	2 × (2/0 ... 500 kcmil), Front clamping point only: 1 × (3/0 ... 600 kcmil) Rear clamping point only: 1 × (250 kcmil ... 500 kcmil)
- Ribbon cable conductors (number x width x thickness)	mm	--		With 3RT19 55-4G box terminal: 2 × (6 × 15.5 × 0.8), 1 × (3 × 9 × 0.8 ... 6 × 15.5 × 0.8) With 3RT19 56-4G box terminal: 2 × (10 × 15.5 × 0.8), 1 × (3 × 9 × 0.8 ... 10 × 15.5 × 0.8)	2 × (20 × 24 × 0.5), 1 × (6 × 9 × 0.8 ... 20 × 24 × 0.5)
Connection type		Busbar connections			
• Terminal screw		--		M8 × 25	M10 × 30
• Tightening torque	Nm	--		10 ... 14	14 ... 24
• Conductor cross-section (min./max.)					
- Solid with cable lug	mm ²	--		16 ... 95 ²⁾	50 ... 240 ³⁾
- Stranded with cable lug	mm ²	--		25 ... 120 ²⁾	70 ... 240 ³⁾
- AWG cables, solid or stranded, with cable lug	AWG	--		4 ... 250 kcmil	2/0 ... 500 kcmil
- With connecting bar (max. width)	mm	--		15	25
Connection type		Straight-through transformers			
Diameter of opening	mm	7.5	14	25	--

1) For grounded networks, otherwise 600 V.



2) When connecting cable lugs according to DIN 46235, use the 3RT19 56-4EA1 terminal cover for conductor cross-sections from 95 mm² to ensure phase spacing.

3) When connecting cable lugs according to DIN 46234 for conductor cross-sections from 240 mm² as well as DIN 46235 for conductor cross-sections from 185 mm², use the 3RT19 56-4EA1 terminal cover to ensure phase spacing.

Overload Relays

3RB2 Solid-State Overload Relays

3RB22, 3RB23 for high-feature applications



Type – Overload relay of evaluation module		3RB22 83, 3RB23 83																																							
Size		S00 ... S10/S12																																							
Width		45 mm																																							
Auxiliary circuit																																									
Number of NO contacts		2																																							
Number of NC contacts		2																																							
Auxiliary contacts – assignment		1 NO for the signal "tripped due to overload and/or thermistor", 1 NC for switching off the contactor 1 NO for the signal "tripped due to ground fault", 1 NC for switching off the contactor or ¹⁾ 1 NO for the signal "tripped due to overload and/or thermistor and/or ground fault", 1 NC for switching off the contactor 1 NO for overload warning, 1 NC for switching off the contactor																																							
Rated insulation voltage U_i (degree of pollution 3)	V	300																																							
Rated impulse withstand voltage U_{imp}	kV	4																																							
Auxiliary contacts – contact rating																																									
<ul style="list-style-type: none"> NC contact with alternating current AC-14/AC-15: Rated operational current I_e at U_e: <table> <tr><td>- 24 V</td><td>A</td><td>6</td></tr> <tr><td>- 120 V</td><td>A</td><td>6</td></tr> <tr><td>- 125 V</td><td>A</td><td>6</td></tr> <tr><td>- 250 V</td><td>A</td><td>3</td></tr> </table> NO contact with alternating current AC-14/AC-15: Rated operational current I_e at U_e: <table> <tr><td>- 24 V</td><td>A</td><td>6</td></tr> <tr><td>- 120 V</td><td>A</td><td>6</td></tr> <tr><td>- 125 V</td><td>A</td><td>6</td></tr> <tr><td>- 250 V</td><td>A</td><td>3</td></tr> </table> NC, NO contact with direct current DC-13: Rated operational current I_e at U_e: <table> <tr><td>- 24 V</td><td>A</td><td>2</td></tr> <tr><td>- 60 V</td><td>A</td><td>0.55</td></tr> <tr><td>- 110 V</td><td>A</td><td>0.3</td></tr> <tr><td>- 125 V</td><td>A</td><td>0.3</td></tr> <tr><td>- 250 V</td><td>A</td><td>0.2</td></tr> </table> Conventional thermal current I_{th} Contact reliability (suitability for PLC control; 17 V, 5 mA) 			- 24 V	A	6	- 120 V	A	6	- 125 V	A	6	- 250 V	A	3	- 24 V	A	6	- 120 V	A	6	- 125 V	A	6	- 250 V	A	3	- 24 V	A	2	- 60 V	A	0.55	- 110 V	A	0.3	- 125 V	A	0.3	- 250 V	A	0.2
- 24 V	A	6																																							
- 120 V	A	6																																							
- 125 V	A	6																																							
- 250 V	A	3																																							
- 24 V	A	6																																							
- 120 V	A	6																																							
- 125 V	A	6																																							
- 250 V	A	3																																							
- 24 V	A	2																																							
- 60 V	A	0.55																																							
- 110 V	A	0.3																																							
- 125 V	A	0.3																																							
- 250 V	A	0.2																																							
Short-circuit protection																																									
• With fuse, gL/gG operational class	A	6																																							
• With miniature circuit breaker (C characteristic)	A	1.6																																							
Protective separation between main and auxiliary conducting path Acc. to IEC 60947-1	V	300																																							
CSA, UL, UR rated data																																									
Auxiliary circuit – switching capacity		B300, R300																																							
Connection of the auxiliary circuit																																									
Connection type		 Screw terminals																																							
• Terminal screw		Pozidriv size 2																																							
• Tightening torque	Nm	0.8 ... 1.2																																							
• Conductor cross-section (min./max.), 1 or 2 conductors																																									
- Solid	mm ²	1 × (0.5 ... 4), 2 × (0.5 ... 2.5)																																							
- Finely stranded without end sleeve	mm ²	--																																							
- Finely stranded with end sleeve	mm ²	1 × (0.5 ... 2.5), 2 × (0.5 ... 1.5)																																							
- Stranded	mm ²	--																																							
- AWG cables, solid or stranded	AWG	2 × (20 ... 14)																																							
Connection type		 Spring-type terminals																																							
• Conductor cross-section (min./max.), 1 or 2 conductors																																									
- Solid	mm ²	2 × (0.25 ... 1.5)																																							
- Finely stranded without end sleeve	mm ²	--																																							
- Finely stranded with end sleeve	mm ²	2 × (0.25 ... 1.5)																																							
- Stranded	mm ²	2 × (0.25 ... 1.5)																																							
- AWG cables, solid or stranded	AWG	2 × (24 ... 16)																																							

1) The assignment of auxiliary contacts may be influenced by function expansion modules.

Overload Relays

3RB2 Solid-State Overload Relays

3RB22, 3RB23 for high-feature applications

Type – Overload relay of evaluation module		3RB22 83, 3RB23 83
Size		S00 ... S10/S12
Width		45 mm
Control and sensor circuit as well as the analog output		
Rated insulation voltage U_i (degree of pollution 3) ¹⁾	V	300
Rated impulse withstand voltage U_{imp} ¹⁾	kV	4
Rated control supply voltage U_s ¹⁾		
• AC 50/60 Hz	V	24 ... 240
• DC	V	24 ... 240
Operating range ¹⁾		
• AC 50/60 Hz		$0.85 \times U_{s \min} \leq U_s \leq 1.1 \times U_{s \max}$
• DC		$0.85 \times U_{s \min} \leq U_s \leq 1.1 \times U_{s \max}$
Rated power ¹⁾		
• AC 50/60 Hz	W	0.5
• DC	W	0.5
Mains buffering time ¹⁾	ms	200
Thermistor motor protection (PTC thermistor detector) ²⁾		
• Summation cold resistance	k Ω	≤ 1.5
• Response value	k Ω	3.4 ... 3.8
• Return value	k Ω	1.5 ... 1.65
Ground-fault detection		
The information refers to sinusoidal residual currents at 50/60 Hz		
• Tripping value I_{Δ} ³⁾		
- For $0.3 \times I_e < I_{motor} < 2.0 \times I_e$		$> 0.3 \times I_e$
- For $2.0 \times I_e < I_{motor} < 8.0 \times I_e$		$> 0.15 \times I_{motor}$
• Response time t_{trip}	ms	500 ... 1000
Analog output ³⁾⁴⁾		
• Output signal	mA	4 ... 20
• Measuring range		0 to $1.25 \times I_e$ 4 mA corresponds to $0 \times I_e$ 16.8 mA corresponds to $1.0 \times I_e$ 20 mA corresponds to $1.25 \times I_e$
• Load, max.	Ω	100
Connection for the control and sensor circuit as well as the analog output		
Connection type		 Screw terminals
• Terminal screw		Pozidriv size 2
• Tightening torque	Nm	0.8 ... 1.2
• Conductor cross-section (min./max.), 1 or 2 conductors		
- Solid	mm ²	1 × (0.5 ... 4), 2 × (0.5 ... 2.5)
- Finely stranded without end sleeve	mm ²	--
- Finely stranded with end sleeve	mm ²	1 × (0.5 ... 2.5), 2 × (0.5 ... 1.5)
- Stranded	mm ²	--
- AWG cables, solid or stranded	AWG	2 × (20 ... 14)
Connection type		 Spring-type terminals
• Conductor cross-section (min./max.), 1 or 2 conductors		
- Solid	mm ²	2 × (0.25 ... 1.5)
- Finely stranded without end sleeve	mm ²	--
- Finely stranded with end sleeve	mm ²	2 × (0.25 ... 1.5)
- Stranded	mm ²	2 × (0.25 ... 1.5)
- AWG cables, solid or stranded	AWG	2 × (24 ... 16)

1) Control circuit.

2) Sensor circuit.

3) In conjunction with corresponding function expansion module.

4) Analog input modules, e. g. SM 331, must be configured for 4-wire measuring transducers. In this case the analog input module must not supply current to the analog output of the 3RB22/3RB23 relay.

Overload Relays

3RB2 Solid-State Overload Relays

3RB22, 3RB23 for high-feature applications

Short-circuit protection with fuses for motor feeders

For short-circuit currents up to 50 kA or 100 kA
at rated operational voltages up to 690 V

Overload relays	Contac-tors	CLASS 5 and 10			CLASS 20			CLASS 30			690 V/ 50 kA	690 V/ 100 kA		690 V/50 kA	415 V/50 kA	600 V/ SSCR	
											Fuse links ¹⁾			Fuses ¹⁾	Acc. to BS 88	Listed acc. to UL, RK 5 CL. L	
											LV HRC			Type 3NA			Type 3ND
											DIAZED			Type 5SB			
										NEOZED	Type 5SE						
											Operational class gG		aM				
Setting range	Type	Rated operational current I_e AC-3 in A at ... V									Rated operational current I_e AC-3 in A for type of coordination ²⁾						
A		400	500	690	400	500	690	400	500	690	1	2	1	2	2	2	--
Size S00/S0 ³⁾																	
0.3 ... 3	3RT10 15	3	3	3	3	3	3	3	3	3	35	20	20	20	--	20	10
	3RT10 16	3	3	3	3	3	3	3	3	3	35	20	20	20	--	20	10
2.4 ... 25	3RT10 15	7	5	4	7	5	4	7	5	4	35	20	20	20	--	20	60
	3RT10 16	9	6.5	5.2	9	6.5	5.2	9	6.5	5.2	35	20	20	20	--	20	60
	3RT10 17	12	9	6.3	10	9	6.3	9	9	6.3	35	20	20	20	--	20	60
	3RT10 23	9	6.5	5.2	9	6.5	5.2	--	--	--	63	25	25	25	--	25	70
	3RT10 24	12	12	9	12	12	9	12	12	9	63	25	25	25	20	25	70
	3RT10 25	17	17	13	16	16	13	14	14	13	63	25	25	25	20	25	70
	3RT10 26	25	18	13	16	16	13	14	14	13	100	35	35	35	20	25	100
	3RT10 34	25	25	20	22.3	22.3	20	19.1	19.1	19.1	125	63	63	63	50	63	100
	3RT10 35	25	25	24	25	25	24	25	25	24	125	63	63	63	50	63	100
Size S2/S3 ³⁾																	
10 ... 100	3RT10 34	32	32	20	22.3	22.3	20	19.1	19.1	19.1	125	63	63	63	50	63	125
	3RT10 35	40	40	24	29.4	29.4	24	26.5	26.5	24	125	63	63	63	50	80	150
	3RT10 36	50	50	24	32.7	32.7	24	26.5	26.5	24	160	80	80	80	50	80	200
	3RT10 44	65	65	47	49	49	47	41.7	41.7	41.7	200	125	125	125	63	125	250
	3RT10 45	80	80	58	53	53	53	45	45	45	200	160	160	160	80	160	300
	3RT10 46	95	95	58	59	59	58	50	50	50	200	160	160	160	100	160	350
	3RT10 54	100	100	100	81.7	81.7	81.7	69	69	69	355	315	315	315	160	250	400
	3RT10 55	--	--	--	100	100	100	90	90	90	355	315	315	315	200	315	400
Size S6																	
20 ... 200	3RT10 54	115	115	115	81.7	81.7	81.7	69	69	69	355	315	315	315	160	250	450
	3RT10 55	150	150	150	107	107	107	90	90	90	355	315	315	315	200	315	500
	3RT10 56	185	185	170	131	131	131	111	111	111	355	315	315	315	200	315	500
Size S10/S12																	
63 ... 630	3RT10 64	225	225	225	160	160	160	135	135	135	500	400	400	400	250	400	600
	3RT10 65	265	265	265	188	188	188	159	159	159	500	400	400	400	315	400	700
	3RT10 66	300	300	280	213	213	213	180	180	180	500	400	400	400	315	400	800
	3RT10 75	400	400	400	284	284	284	240	240	240	630	500	500	500	400	450	1000
	3RT10 76	500	500	450	355	355	355	300	300	300	630	500	500	500	500	500	1200
	3RT12 64	225	225	225	225	225	225	173	173	173	500	500	500	500	400	450	600
	3RT12 65	265	265	265	265	265	265	204	204	204	500	500	500	500	400	450	700
	3RT12 66	300	300	300	300	300	300	231	231	231	500	500	500	500	400	450	800
	3RT12 75	400	400	400	400	400	400	316	316	316	800	800	800	--	630	800	1000
	3RT12 76	500	500	500	500	500	500	385	385	385	800	800	800	--	630	800	1200
	3TF68 ³⁾	630	630	630	440	440	440	376	376	376	800	500 ⁴⁾	500 ⁴⁾	500 ⁴⁾	630	500	1600
	3TF69 ³⁾	630	630	630	572	572	572	500	500	500	800	630 ⁴⁾	630 ⁴⁾	--	630	630	1600
Size 14																	
0.3 ... 3 ⁵⁾	3TF69 ³⁾	820	820	820	572	572	572	500	500	500	800	630 ⁴⁾	630 ⁴⁾	--	630	630	1600

1) Please observe operational voltage.

SSCR = Standard Short-Circuit Rating

2) Assignment and short-circuit protective devices according to IEC 60947-4-1:

The contactor or starter must not endanger persons or the installation in the event of a short-circuit.

Type of coordination "1": The contactor or the starter may be non-operational after every short-circuit release.

Type of coordination "2": The contactor or the starter must be operational after a short-circuit release (without replacement of parts). There is a risk of contact welding.

3) Contactors not mountable.

4) Please ensure that the maximum AC-3 operational current has sufficient safety clearance from the rated current of the fuses.

5) With 3UF18 68-3GA00 current transformer.

Overload Relays

3RB2 Solid-State Overload Relays

3RB22, 3RB23 for high-feature applications

Characteristic curves

The tripping characteristics show the relationship between the tripping time and tripping current as multiples of the current setting I_e and are given for symmetrical three-pole and two-pole loads from the cold state.

The smallest current used for tripping is called the minimum tripping current. According to IEC 60947-4-1, this current must be within specified limits. The limits of the minimum tripping current for the 3RB22/3RB23 solid-state overload relays for symmetrical three-pole loads lie between 105 and 120 % of the current setting.

The tripping characteristic starts with the minimum tripping current and continues with higher tripping currents based on the characteristics of the so-called trip classes (CLASS 10, CLASS 20 etc.). The trip classes describe time intervals within which the overload relays have to trip with 7.2 times the current setting I_e from the cold state for symmetrical three-pole loads.

The tripping times according to IEC 60947-4-1, tolerance band E, are as follows for:

Trip class	Tripping time
CLASS 5	3 ... 5 s
CLASS 10	5 ... 10 s
CLASS 20	10 ... 20 s
CLASS 30	20 ... 30 s

The tripping characteristic for a three-pole overload relay from the cold state (see illustration 1) only apply if all three phases are simultaneously loaded with the same current. In the event of a phase failure or a current unbalance of more than 40 %, the 3RB22/3RB23 solid-state overload relays switch off the contactor more quickly in order to minimize heating of the load in accordance with the tripping characteristic for two-pole loads from the cold state (see illustration 2).

Compared with a cold load, a load at operating temperature obviously has a lower temperature reserve. The tripping time of the 3RB22/3RB23 solid-state overload relays is reduced therefore to about 20 % when loaded with the current setting I_e for an extended period.

Tripping characteristics for 3-pole loads

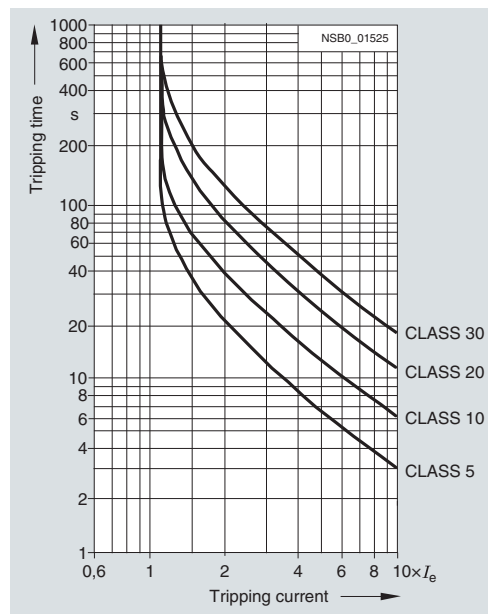


Illustration 1

Tripping characteristics for 2-pole loads

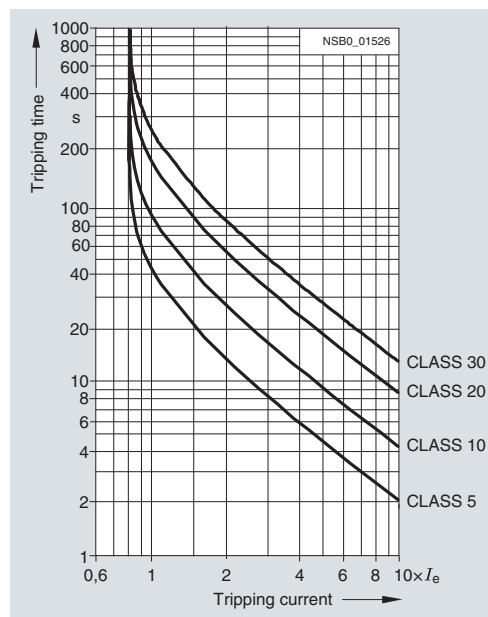


Illustration 2

The above illustrations are schematic representations of characteristic curves. The characteristic curves of the individual 3RB22/3RB23 electronic overload relays can be ordered from "Technical Assistance":

- Either by e-mail to:
technical-assistance@siemens.com
- Or on the Internet at:
<http://www.siemens.com/automation/service&support>

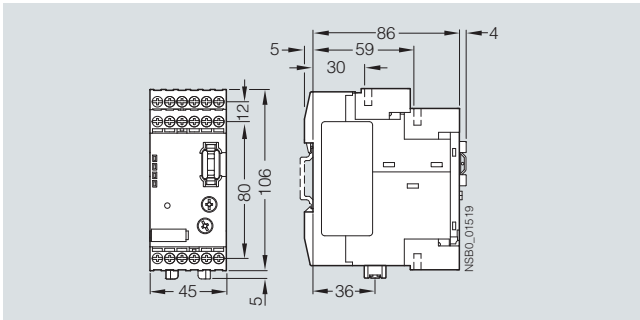
Overload Relays

3RB2 Solid-State Overload Relays

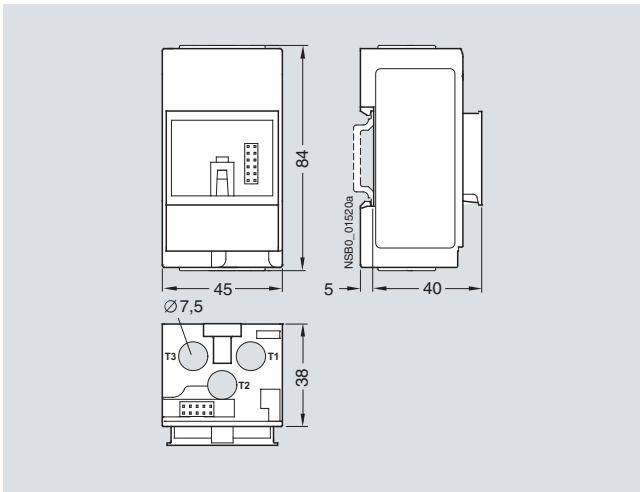
3RB22, 3RB23 for high-feature applications

Dimensional drawings

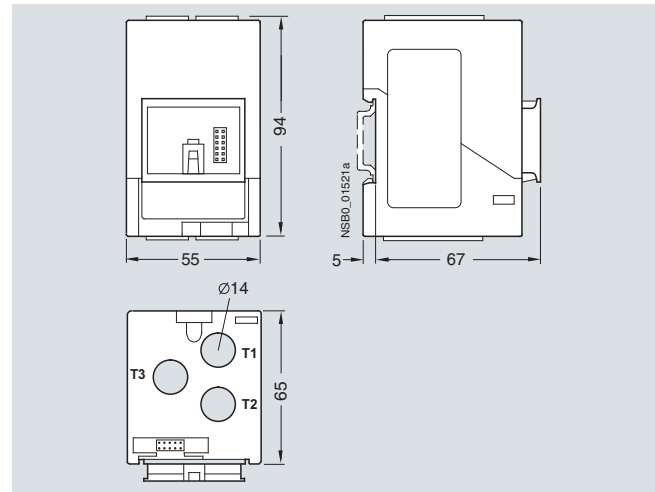
3RB22 83-4, 3RB23 83-4 evaluation module



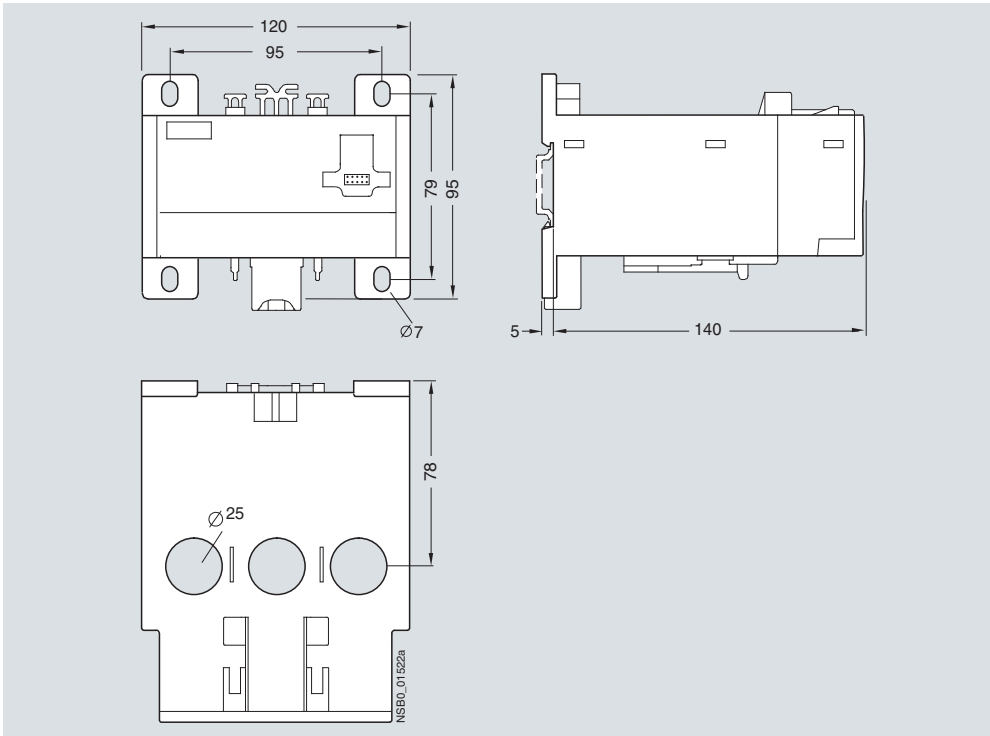
3RB29 06-2BG1, 3RB29 06-2DG1 current measuring module



3RB29 06-2JG1 current measuring module



3RB29 56-2TG2 current measuring module

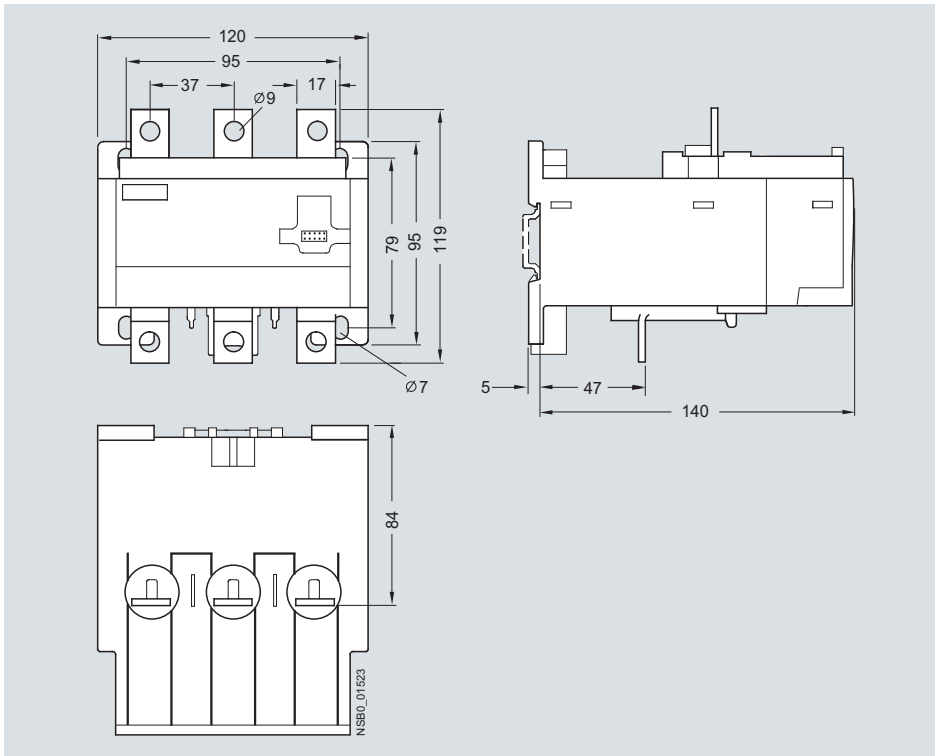


Overload Relays

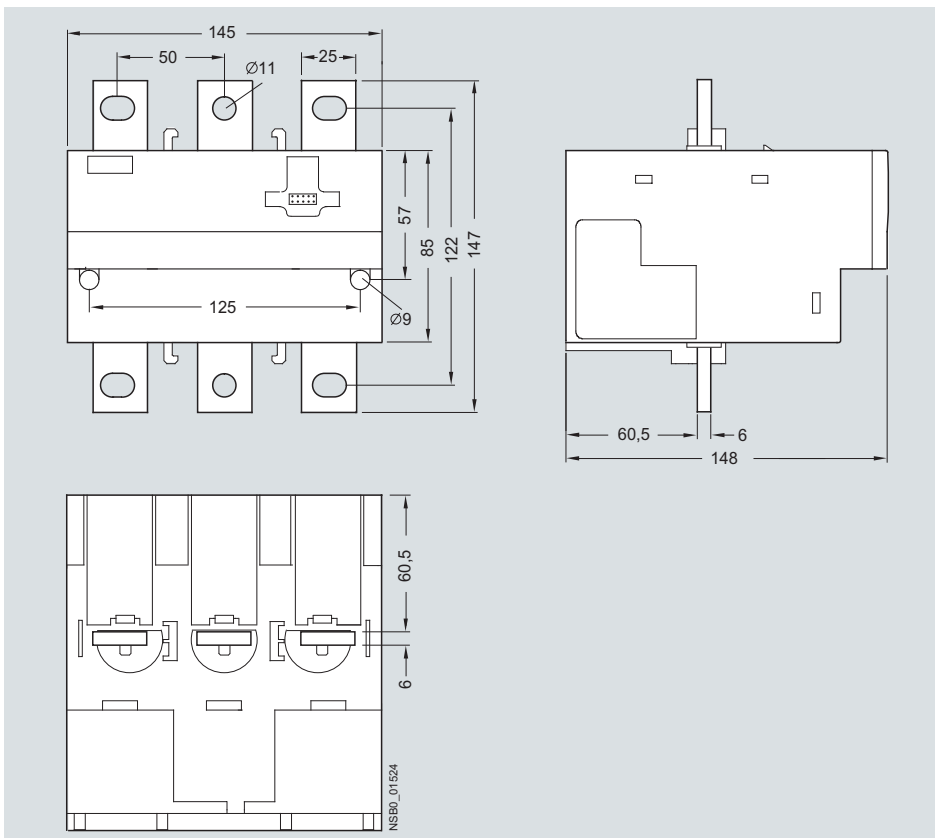
3RB2 Solid-State Overload Relays

3RB22, 3RB23 for high-feature applications

3RB29 56-2TH2 current measuring module



3RB29 66-2WH2 current measuring module



Overload Relays

3RB2 Solid-State Overload Relays

3RB22, 3RB23 for high-feature applications

Connections

Evaluation modules	With function expansion module	Basic functions	Inputs		
			A1/A2	T1/T2	Y1/Y2
3RB22 83-4AA1 3RB22 83-4AC1 3RB23 83-4AA1 3RB23 83-4AC1	--	Inverse-time delayed protection, temperature-dependent protection, electrical remote RESET, overload warning	Power supply 24 ... 240 V AC/DC	Connection for PTC sensor	Electrical remote RESET
	3RB29 85-2CA1	Inverse-time delayed protection, temperature-dependent protection, internal ground-fault detection, electrical remote RESET, overload warning	Power supply 24 ... 240 V AC/DC	Connection for PTC sensor	Electrical remote RESET
	3RB29 85-2CB1	Inverse-time delayed protection, temperature-dependent protection, internal ground-fault detection, electrical remote RESET, ground-fault signal	Power supply 24 ... 240 V AC/DC	Connection for PTC sensor	Electrical remote RESET
	3RB29 85-2AA0	Inverse-time delayed protection, temperature-dependent protection, electrical remote RESET, overload warning, analog output	Power supply 24 ... 240 V AC/DC	Connection for PTC sensor	Electrical remote RESET
	3RB29 85-2AA1	Inverse-time delayed protection, temperature-dependent protection, internal ground-fault detection, electrical remote RESET, overload warning, analog output	Power supply 24 ... 240 V AC/DC	Connection for PTC sensor	Electrical remote RESET
	3RB29 85-2AB1	Inverse-time delayed protection, temperature-dependent protection, internal ground-fault detection, electrical remote RESET, ground-fault signal, analog output	Power supply 24 ... 240 V AC/DC	Connection for PTC sensor	Electrical remote RESET

Evaluation modules	With function expansion module	Outputs				
		I (-) / I (+)	95/96 NC	97/98 NO	05/06 NC	07/08 NO
3RB22 83-4AA1 3RB22 83-4AC1 3RB23 83-4AA1 3RB23 83-4AC1	--	No	Disconnection of the contactor (inverse-time delayed/temperature-dependent protection)	Signal "tripped"	Overload warning	Overload warning
	3RB29 85-2CA1	No	Disconnection of the contactor (inverse-time delayed/temperature-dependent protection + ground fault)	Signal "tripped"	Overload warning	Overload warning
	3RB29 85-2CB1	No	Disconnection of the contactor (inverse-time delayed/temperature-dependent protection)	Signal "tripped"	Switching off the contactor (ground fault)	Signal "ground-fault tripping"
	3RB29 85-2AA0	Analog signal	Disconnection of the contactor (inverse-time delayed/temperature-dependent protection)	Signal "tripped"	Overload warning	Overload warning
	3RB29 85-2AA1	Analog signal	Disconnection of the contactor (inverse-time delayed/temperature-dependent protection + ground fault)	Signal "tripped"	Overload warning	Overload warning
	3RB29 85-2AB1	Analog signal	Disconnection of the contactor (inverse-time delayed/temperature-dependent protection)	Signal "tripped"	Switching off the contactor (ground fault)	Signal "ground-fault tripping"

Overview

Overload relays for standard applications

The following accessories are available for the 3RB20/3RB21 solid-state overload relays:

- One terminal bracket each for the overload relays size S00 and S0 (sizes S2 to S12 can be installed as stand-alone installation without a terminal bracket)
- One mechanical remote RESET module for all sizes
- One cable release for resetting devices which are difficult to access (for all sizes)
- One sealable cover for all sizes
- Box terminal blocks for sizes S6 and S10/S12
- Terminal covers for sizes S2 to S10/S12


Overload relays for high-feature applications

The following accessories are available for the 3RB22/3RB23 solid-state overload relays:

- A sealable cover for the evaluation module
- Box terminal blocks for the current measuring modules size S6 and S10/S12
- Terminal covers for the current measuring modules size S6 and S10/S12

Technical specifications

Terminal brackets for stand-alone installation

Type	3RB29 13-0AA1		3RB29 23-0AA1	
For overload relays	3RB20 16, 3RB21 13		3RB20 26, 3RB21 23	
Size	S00		S0	
General data				
Type of mounting		For screw and snap-on mounting onto TH 35 standard mounting rail		
Connection for main circuit				
Connection type		<div> Screw terminals</div>		
• Terminal screw		Pozidriv size 2		
• Tightening torque	Nm	0.8 ... 1.2		2 ... 2.5
• Conductor cross-section (min./max.), 1 or 2 conductors				
- Solid	mm ²	1 × (0.5 ... 2.5), max. 1 × (... 4)		1 × (1 ... 6), max. 1 × (... 10)
- Finely stranded without end sleeve	mm ²	--		--
- Finely stranded with end sleeve	mm ²	1 × (0.5 ... 2.5)		1 × (1 ... 6)
- Stranded	mm ²	1 × (0.5 ... 2.5), max. 1 × (... 4)		1 × (1 ... 6), max. 1 × (... 10)
- AWG cables, solid or stranded	AWG	1 × (18 ... 14)		1 × (14 ... 10)

Get more information

Low-Voltage Controls and Distribution
www.siemens.com/lowvoltage

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